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STATISTICAL DATA FOR THE STUDY OF THE ASSIMILATION OF RACES AND NATIONALITIES IN THE UNITED STATES.

By Richmond Mayo-Smith.

In the philosophy of history, and in the more modern science of politics, we meet constantly with references to the influence of race and nationality on the institutions and history of certain peoples. The inference seems to be that certain institutions are due to the character or peculiarities of certain races; for instance, that local self-government, whether found in England, in the United States, in Canada, in Australia, or in the Cape Colony, may safely be ascribed to the influence of the Anglo-Saxons.

This principle is based upon the evidence of history and the comparative study of institutions. The evidence, however, is necessarily of a vague and general character. It consists mainly in the fact that we find people going out from the same mother-land carrying with them and perpetuating the same general form of institution. But it is impossible to say exactly how much the institutions are really due to the character of the people, and how much they are simply manifestations of the same social circumstances.

A similar lack of precision but confidence in generalization is seen in the customary historical analysis of the mixing of two races. Certain national habits and customs are attributed to the one race, and certain ones to the other race. Sometimes there is a division of the social organization, some institutions, it being asserted, being due to one race, and certain other institutions to the other. But the distance of these events, and the lack of exact information as to the number and distribution of the population, make any close analysis of the influence of national characteristics impossible.

In modern times the remarkable influx of men of different nationalities and races into the United States, and their settling side by side, suggests the inquiry whether we are not in a position to analyze to better advantage than ever before the effect of race character upon institutions and of races upon each other. The advantages that we enjoy for this study at the present time are three-fold: —

(1) The nations of Europe during the last fifteen hundred years have by constant rivalry and contest developed real national characteristics which they bring with them to America. (2) In America these different nationalities are subjected to the same conditions, and occupy the same position of equality. Each nationality, therefore, has a chance to make its characteristic dominant. (3) We have a statistical basis for this study in the census enumeration of persons of foreign birth and of foreign parentage, and their distribution.

The purpose of this paper is to determine the statistical data which bear upon these questions, and their respective validity. The ultimate purpose of the whole inquiry is to determine whether the controlling factors in the resultant of the mixture of different nationalities or races are: (1) Race character, (2) physical environment, or (3) social influences.

In this brief synopsis it is impossible to go into all the details, but the general course of the inquiry is as follows: —

We must conceive of the history of the United States as a

gradual but continuous process of mixture and assimilation of men of different races and nationalities. The process is not yet complete, and it is due to this very fact that we are still able to analyze and to study it. For our statistics show us sections of the population composed in varying proportions of men of different nationalities; and our study of institutions shows us the institutions belonging to these same populations. By comparison of the likenesses or differences between the two, we may detect variations which may be ascribed to the influence of race.

We must remark, however, that in the history of the population of the United States it is necessary to make allowance for two great influences which have always been present, and which at the beginning were quite overwhelming in giving an impress to the colonists from whatever nationality they may have come. The first of these was the effect of settlement in an entirely new country, so far from the mother-country as to be practically free from her influence, and so exposed to danger that it demanded extraordinary courage and self-reliance. Here was an influence of environment demanding the development of certain qualities at all cost, even on penalty of annihilation. With the extension of colonization westward the same qualities were demanded, and have even in recent times been made manifest in the mining camps, and on the cattle ranges of the far West, just as they were in the earliest settlements.

The second influence, and one which has been permanent and powerful, is that of established institutions. Owing to the fact that the majority of the early settlers were English, and that the immigration at first was extremely moderate, time was given to fix the institutions on the English model. Later immigration from many different nations has been received into the mould thus prepared, and, not having the cohesion necessary for separate existence, has taken on this form. The intermixture of races caused by the immigration of the nineteenth century, unlike that of former

times, has not been due to a war of nationalities; it has been the absorption by a nationality of individuals from other nations. It has been an unequal contest of the individual immigrants against powerfully established national customs and firmly rooted institutions. This influence became especially powerful with the establishment of our national government, and has remained powerful ever since.

Such being the great controlling influences which have tended to keep all the elements introduced into this country within the bounds, so to speak, of American development, we may ask what movement has been going on within these limits. This movement, in my opinion, may be studied under three aspects.

There has been, in the first place, an assimilation, an intermixture of the natives (first comers) and the foreigners (late comers), which has resulted in a population unlike either the native-born American, or the foreign born of any one nationality.

In the second place, there may have been a change in the character of the foreign-born element, owing to its subjection to new influences.

In the third place, there may have been direct influence exerted on the native character by the presence of the new foreign element. The question now is whether we can get any statistical data enabling us to determine the strength of these three influences.

INFLUENCES TENDING TO ASSIMILATE THE FOREIGN AND THE NATIVE ELEMENTS IN THE UNITED STATES.

The problem we have before us here is to determine whether the conditions now prevailing in the population of the United States are favorable to assimilation; how far the process has probably gone; and whether we can distinguish the results of the process.

Our first step is to determine the elements of the popula-

tion. For this purpose the Eleventh Census gives us the following classification: —

TABLE I.— POPULATION OF THE UNITED STATES ACCORDING TO COLOR, BIRTH-PLACE, AND PARENTAGE.

Total population	62,622,250	100.00 per cent.
Colored population	7,638,360	12.20 "
Native White, native parents	34,358,348	54.87 "
Native White, foreign parents	11,503,675	18.37 "
Foreign White	9,121,867	14.56 "
Total of last two	20,625,542	32.93 "

We have here four different elements entering into the population of the United States. The native Americans, that is, the Native Whites, whose parents are native born, number a little over one-half of the total population. This, indeed, carries us back only one generation. The grandparents of these persons may have been, and probably were, in many cases, foreign born, so that it is safe to say that less than one-half of the people of the United States are descendants of the whites who were here at the beginning of this century. Upon this native American element is imposed three elements different either in race, or in birth-place, or in parentage. The first is the colored, 12.2 per cent of the total population, composed principally of negroes. They constitute a peculiar element in the American population, the importance of which is very great, but whose study differs from that of the foreign element for two reasons, viz., that color seems to be an effectual hindrance to marriage with the whites, and thus no amalgamation of blood will ever be possible; and their previous history gives them a peculiar position in American civilization. They are in many respects an inferior race, but they are native-born Americans, and the only civilization they know is American. Hence, they are not so much an alien element as a peculiar one, separated from the rest of the community by an ineradicable mark, and yet inseparably bound to the community.

The second element, 14.56 per cent of the whole, is com-

posed of white persons born abroad, that is, the survivors of the immigrants to this country. This is the element through whom the direct foreign influence, whether for good or for evil, upon the institutions and the people of this country is exercised. It is, therefore, extremely important to know what and how great this influence is. This is properly the question of the direct effect of immigration upon the United States, and will not be entered upon here. For our purpose it is important to know whether this element, foreign by birth, yields to the dissolving influence of American life, or whether it remains alien in character and influence.

The third element is constituted of native white persons whose parents were foreign born. They may be called the second generation of the immigrants. It is evident that there may be, and probably is, an important difference between these last two classes. The native-born whites of foreign parentage are not to be regarded entirely as foreigners. Born on this soil, reared in our community, educated in the public schools, they lose the quality of foreigners and acquire the characteristics of natives. It is true that where they are massed together this does not always happen, for they may then retain a foreign language and all the habits of their foreign parentage. But it is evident that unless thus massed the new generation will tend to disintegrate and assimilate itself more readily to the native Americans than did the original foreign-born ancestors.

The relative proportion of these three elements in the white population gives us an important indication of the influence of immigration in each state. For instance, in New England we have the following contrasts: —

TABLE II.—POPULATION OF MAINE AND OF MASSACHUSETTS.

	Maine.	Massachusetts.
Native Whites, native parents	76.75 per cent.	42.67 per cent.
Foreign-born Whites	11.30 "	29.19 "
Native Whites, foreign parents	11.17 "	27.09 "

We have here a very marked difference in the character of the population of two New England states. The problem of assimilating the foreign element would seem to be much more difficult in the case of Massachusetts than in the case of Maine. So, also, if difference in nationality has a very marked influence on institutions, one would expect to find the institutions and the legislation of the two states very different. These comparisons between neighboring states, or between different sections of the same state, might be carried out indefinitely, and I believe would be fruitful of results.

A second contrast seems to me even more important. This is the relative proportion in different communities of the second generation of immigrants to the first. It must be conceded that it is the children of the immigrants whom we expect to become fully Americanized. Where, therefore, this second generation is already large compared with the first, we may say that the process of assimilation is already begun, and has a good basis to work upon. On the other hand, where the foreign element is still composed mainly of the original immigrants, then we may say that the task of assimilation is still before us. In order to measure the relative strength of the second generation and the first, I have taken the proportion of native whites of foreign parents to the foreign-born whites in the principal states of the North Atlantic and the North Central divisions. The results are as follows: —

TABLE III.—PROPORTION OF NATIVE WHITES OF FOREIGN PARENTAGE TO FOREIGN-BORN WHITES.

The United States, . . .	126.11	Native Whites,	Foreign Parents,	to	100	Foreign	Whites.	
North Atlantic Division, .	112.40	"	"	"	"	"	"	"
Maine, ...	93.86	"	"	"	"	"	"	"
New Hampshire, . . .	69.27	"	"	"	"	"	"	"
Vermont, ...	141.17	"	"	"	"	"	"	"
Massachusetts, ...	92.79	"	"	"	"	"	"	"
Rhode Island, ...	88.92	"	"	"	"	"	"	"
Connecticut, ...	105.38	"	"	"	"	"	"	"
New York, ...	117.35	"	"	"	"	"	"	"
New Jersey, ...	113 38	"	"	"	"	"	"	"
Pennsylvania, ...	126.43	"	"	"	"	"	"	"

North Central Division,	138.35	Native Whites,	Foreign Parents,	to 100	Foreign Whites.				
Ohio,	172.65	"	"	"	"	"	"	"	
Indiana,	207.34	"	"	"	"	"	"	"	
Illinois,	124.23	"	"	"	"	"	"	"	
Michigan,	113.29	"	"	"	"	"	"	"	
Wisconsin,	140.04	"	"	"	"	"	"	"	
Minnesota,	110.93	"	"	"	"	"	"	"	
Iowa,	158.42	"	"	"	"	"	"	"	
Missouri,	186.82	"	"	"	"	"	"	"	
North Dakota,	77.87	"	"	"	"	"	"	"	
South Dakota,	120.22	"	"	"	"	"	"	"	
Nebraska,	123.82	"	"	"	"	"	"	"	
Kansas,	160.26	"	"	"	"	"	"	"	

The results of this comparison are in some cases surprising. In most of the states the native whites of foreign parents are more numerous than the foreign born, that is, the second generation is more numerous than the first. This is true even of such states as Wisconsin and Minnesota, which we think of particularly as peopled by immigrants. On the other hand, in four of the New England states the second generation is not as numerous as the first. This seems to me to indicate that the eastern states have a more difficult task before them than the states of the northwest. Comparison between different states may be carried out indefinitely.

Having thus defined the relative proportions of the elements to be assimilated in the different parts of the United States, the next question is, what effect those influences which tend towards assimilation will have upon these elements, and with what prospect of success.

There are three forces tending towards assimilation: Intermarriage, common-school education, and the exercise of political rights.

Inter-Marriage.

Assimilation by inter-marriage is the natural way of welding diverse nationalities or races into one nation. Thereby is brought about an actual intermixture of blood, and a community of customs and habits of life, which efface any previous differences. In course of time this assimilation will undoubtedly take place in the United States among the

foreign born whites, for there are no particularly strong national prejudices to be overcome, and the second and third generations will feel themselves more American than anything else. It is improbable that we shall ever be able to trace this statistically, for all these persons will be classified as native born, and the distinction of parentage will at best be carried back only one generation. But it is principally in the second and third generation that we are to seek this amalgamation by inter-marriage of Americans with persons of other nationality; for the immigrants who come here are either already married, or will naturally marry persons of the same race with whom they associate, and to whom they are drawn by language or by acquaintanceship.

The inquiry in regard to the parentage of persons shows us a certain number of mixed parentage. The Tenth Census made the interesting deduction that where a nationality was numerously represented in a locality there was little tendency for its members to marry natives or persons of another nationality. But where a nationality was not numerously represented there was a much greater tendency to marry with others. This deduction was confirmed by the Massachusetts Census of 1885, and the Eleventh Census will give us further opportunity to test it. It seems probable, however, that amalgamation by marriage will not be for the first two generations an assimilating force of any great importance.

Common-School Education.

This has always been regarded in the United States as perhaps the most important influence in converting the immigrants, many of them uneducated, some of them not even speaking the English language, into good American citizens.

The question for us is to determine statistically how far the foreign elements are receptive to this influence, and what the result has been. I shall be able barely to enumerate the different lines of inquiry.

The proportion of the immigrants who already speak Eng-

lish is important, for it is evident that they can more readily take advantage of our educational facilities than those who speak a foreign language. Out of 15,427,657 immigrants who arrived here from 1820 to 1890 about 40 per cent were put down as coming from Great Britain and Ireland, while 6.79 were put down as coming from British North America. This proportion of English-speaking immigrants is decreasing. In 1891 the proportion of immigrants from Great Britain and Ireland was less than 22 per cent of the total, and the immigrants from British North America overland were no longer reported.

A second fact of importance is whether the immigrants come from a country where the greater portion of the people have already received common-school education. In this respect we may contrast the Germans, Swedes, and Norwegians with the Italians, Hungarians, and Russians.

But a more important consideration seems to me to be whether the foreign element is composed of immigrants who are already too old to come under the influence of our education, or of the second generation who have been in our schools, or are in them now. The first element is represented by the 8,332,072 foreign-born persons in the United States above the school age. The second element is represented by the 11,503,675 native whites of foreign parentage who either have had or are now having the opportunity of education here. To these must be added the 917,475 foreign-born persons still of school age, making 12,521,150. This element I designate as the schooled and schoolable element. It is to be contrasted with the 8,332,072 unschooled, that is, who have never been submitted to the influence of education in this country. This classification is not applicable, of course, to individual cases, but it will give us a general notion of how far the foreign elements are capable of being influenced by our common-school system.

If we represent the foreign element beyond the school age by 100, the strength of the schooled and schoolable will be

represented by 151.39. The proportion is widely different in different parts of the country, and represents the greatest variety of problems offered by the presence of the foreign born. The general figure would seem to show that the foreign element is in a controllable position, a position where we can bring the influence of our educational system to bear upon it. The comparison of different states and different sections may be followed out as under the previous question.

The direct task imposed upon different states in the matter of education is shown by the total number of children of school age classified as of foreign birth, of native birth and foreign parentage, and of native birth, native parentage. The first element would seem to offer the greatest difficulty, and the last element the least.

The success of the states in meeting this demand is shown by the total enrollment of children in schools, which, according to the last census, was 14,373,670 out of a total of 18,543,207 children of 5 to 17 years of age.

The final success of our educational system must be shown by the statistics of illiteracy. Those for Massachusetts are very interesting as showing that illiteracy in that state is due almost entirely to the presence of the foreign born. They also show a large rate of illiteracy among the native born of foreign parents. This, however, is probably due to the large number of homeless and pauper children in that class. Altogether, education seems to be reaching the second generation.

The Influence of Political Life.

There is no doubt that the exercise of political rights has had a powerful effect in assimilating the men of different nationalities and making them feel like one nation. The policy of the United States in conferring upon persons, coming to this country with the intention of remaining, the same political rights which the native born enjoy has been founded not only upon the doctrine of the equality of men, but also upon the desire to bring all men into a unified body politic.

It is not our intention to discuss the question whether this policy has brought inconveniences or not, or whether we have been too liberal in extending political rights. We look at it simply from the point of view of the assimilating influence which has thereby been exercised. The statistical data for this purpose may be arranged under the following four heads: —

(1) What proportion of the foreign born is subjected to this assimilating influence of the exercise of political rights? In other words, how many of the foreign born are naturalized males?

If we look at the statistics of the proportion of foreign-born males of voting age, we shall find that it is greatly in excess of the proportion of the foreign-born persons to the whole population. For the whole United States the proportion is 25.67 per cent of total males 21 years and over; for the North Atlantic division it is 33.23 per cent; for the North Central division it is 30.97 per cent; in Minnesota it is 58.85 per cent.

This would seem to show that the voting strength of the foreign-born population is very great, in some of the states more than one-half of the total voting strength of the population. But it must be remembered that all these men are not capable of voting, because many of them have not been naturalized, either because they have not been in this country a sufficient length of time, or because they have no desire to exercise political rights. It is curious to see that in the Western states, where there is the greatest proportion of foreign born, there is also the greatest proportion of them naturalized, showing that the immigration is of an older date, or that the immigrants are more disposed to be naturalized than they are in the Eastern states.

In the whole of the United States only 58.55 per cent of the foreign born have been naturalized, that is, a little more than one-half. In the Western states this proportion ascends to 64.75 per cent, while in the Eastern states it is only 54.32.

TABLE IV.—SHOWING THE VOTING STRENGTH OF THE FOREIGN BORN IN THE UNITED STATES.

	Foreign-Born Males 21 Years and Over to 100 Males 21 Years and Over.	Naturalized to 100 Foreign-Born Males 21 Years and Over.	Naturalized Foreign-Born Males to 100 Males 21 Years and Over.
United States	25.67	58.55	15.02
North Atlantic Division	33.23	54.32	18.05
Maine	15.14	36.52	5.52
New Hampshire	22.05	38.90	8.57
Vermont	19.36	46.95	9.08
Massachusetts	38.66	43.76	16.91
Rhode Island	40.18	38.83	15.60
Connecticut	34.99	49.39	17.28
New York	38.73	60.74	23.52
New Jersey	35.08	60.30	21.15
Pennsylvania	27.19	53.19	14.46
North Central Division	30.97	64.75	20.05
Ohio	21.53	70.28	15.13
Indiana	12.33	75.90	9.35
Illinois	36.39	62.12	22.60
Michigan	40.22	58.76	23.63
Wisconsin	52.93	64.71	34.25
Minnesota	58.85	63.67	37.46
Iowa	29.92	68.89	20.61
Missouri	17.11	66.99	11.46
North Dakota	64.89	48.87	31.71
South Dakota	44.35	66.75	29.60
Nebraska	31.80	64.47	20.50
Kansas	19.07	69.37	13.22

In Indiana it is 75.90 per cent, in Ohio 70 per cent, in Kansas 69.37 per cent, in Iowa 68 per cent, while in none of these states, except Michigan and North Dakota, does it descend below 60 per cent. On the other hand, in the Eastern states it is between 36.52 per cent in Maine and 60.74 in New York. We find, therefore, that the proportionate number of foreign-born persons actually availing themselves of political rights is much greater in the West than in the East. This would seem to show that the assimilating influence has a better chance in the West than in the East.

(2) What is the real strength of the foreign vote in the

total vote? Is this strength sufficient to enable the foreign vote, if cast solidly, to exert an independent power?

This question is answered by giving the proportion of naturalized foreign-born males of voting age to the total number of males of voting age. These proportions are shown in the preceding table. In the whole of the United States the naturalized foreign-born males of voting age constitute 15.02 per cent of the total potential voting population; in the North Atlantic division, 18.05 per cent; in the North Central division, 20.05 per cent. The actual voting strength is, therefore, not very great. With the exception of three or four Western states, it is about one-fifth. In some of the Eastern states it is insignificant, and in no state has it an absolute majority. It does not seem probable, therefore, that there is any danger of the foreign vote being kept solidly together in such a way as to resist the dissolving influence of American political life. To do so would require very great influence among the leaders, and a similarity of aims among the different nationalities, which does not exist.

A comparison of the figures in the different states shows us a great variety of combinations. In some of them the voting strength is due to the large number of foreigners; in others it is due to the large proportion among the foreigners who are naturalized. For instance, in Pennsylvania only 27 per cent of the voters are foreign-born males, and in Rhode Island 40 per cent; but while in Rhode Island only 38 per cent are naturalized, in Pennsylvania 53 per cent are naturalized, so that the actual voting strength is nearly equal in Pennsylvania to what it is in Rhode Island. There is this difference, however, between the two states, that in Rhode Island the foreign vote may increase rapidly on account of the large number of unnaturalized foreigners, while in Pennsylvania the increase will be much slower.

The general effect of the varying percentage of the naturalized foreign-born males of voting age in the different states is to reduce the effective voting strength of the foreign born,

so that it bears about the same proportion to the whole voting strength as the total number of the foreign born bears to the total population.

TABLE V.—VOTING STRENGTH OF THE FOREIGN BORN IN UNITED STATES COMPARED WITH PROPORTION OF WHOLE POPULATION.

	Proportion of Naturalized Foreign Born to Total Males 21 Years and Over.	Foreign Born of Total Population.
The United States	15.02	14.56
North Atlantic Division	18.05	22.27
North Central Division	20.05	18.13
Minnesota	37.46	35.87
Wisconsin	34.25	30.77
North Dakota	31.71	44.52
South Dakota	29.60	27.63
Michigan	23.63	25.87
New York	23.52	26.11
Illinois	22.60	21.98
New Jersey	21.15	22.70
Nebraska	20.50	19.10
Connecticut	17.28	24.54
Massachusetts	16.91	23.19
Rhode Island	15.60	30.69
Ohio	15.13	12.49
Pennsylvania	14.46	16.04
Kansas	13.23	10.35
Missouri	11.46	8.74
Indiana	9.35	6.66
Vermont	9.08	13.24
New Hampshire	8.57	19.18
Maine	5.52	11.90

(3) Suppose we add the voters of the second generation of the foreign born to the naturalized foreign-born voters? It is sometimes said that we should include all the descendants in estimating the political strength of the foreign element.

In order to get at this figure we add together the native male whites of foreign parentage, 21 years and over, to the number of the naturalized foreigners. We thus get the foreign vote of two generations. Add to this the native male whites of native parentage, 21 years of age and over, and we

have the total actual white voting strength in the United States. The foreign vote of two generations bears a very large proportion to this total vote, as is seen in the following table: —

TABLE VI.—SHOWING STRENGTH OF FOREIGN VOTE OF TWO GENERATIONS TO TOTAL WHITE VOTE.

	Percentage of Foreign Vote of Two Generations to Total White Vote.	Proportion of Foreign Vote of Two Generations to Native American Vote, *i. e.*, Native Whites, Native Parentage.
United States	34.77	53.32 to 100
North Atlantic Division	41.25	70.23 "
Maine	13.97	16.24 "
New Hampshire	17.32	20.92 "
Vermont	24.31	32.12 "
Massachusetts	41.29	70.33 "
Rhode Island	42.10	72.73 "
Connecticut	39.19	64.46 "
New York	52.46	110.38 "
New Jersey	44.54	80.31 "
Pennsylvania	34.42	52.49 "
North Central Division	41.39	70.62 "
Ohio	35.76	55.67 "
Indiana	22.72	29.40 "
Illinois	46.26	86.10 "
Michigan	48.26	93.28 "
Wisconsin	72.50	263.70 "
Minnesota	70.49	238.87 "
Iowa	41.84	71.45 "
Missouri	27.59	38.10 "
North Dakota	68.26	215.13 "
South Dakota	55.64	125.45 "
Nebraska	38.14	61.65 "
Kansas	26.68	36.40 "

In the whole of the United States the foreign vote of two generations is 34.77 per cent of the total vote. In the North Atlantic division it is 41.5 per cent; in the North Central division it is 41.39 per cent; in Wisconsin it is 72.5 per cent; in Kansas it is only 26.68 per cent. The different states show the widest possible contrasts. These contrasts are so great that it is absolutely impossible to believe that the foreign vote

of the two generations is solid. If that were so, two such states as Wisconsin and Kansas would certainly show us very marked differences in their political life. In New York the foreign vote of two generations is more than one-half of the total, while in Pennsylvania it is only one-third. Is there any indication of this in the condition of the two commonwealths? The obvious answer to these queries is that the second generation of voters have been subjected to the solvent influence of American educational and political institutions. It is an indication of the assimilating influence of American life that, where we have these striking differences in the constitution of the population of different states, we do not find corresponding differences in their political life. It needs but little exercise of the imagination to picture how radically and peculiarly these communities would differ from each other if the process of assimilation had not gone on, if the second, or even the first, generation had retained the habits, customs, and feelings of their native land. This same picture enables us to realize how powerful the assimilating force has been.

(4) The fourth arrangement of figures is intended to show the relation of the voters of the second generation to the naturalized foreign-born voters. For, if the second generation has felt the influence of American life, its strength, as compared to the foreign born, is a matter of great importance. We find in the United States that for every one hundred naturalized voters there are 84.45 native voters of foreign parentage. In the North Atlantic division the proportion is 90.23 per cent to 100. In the Western states it is not generally so great as in the Eastern, but even in Wisconsin there are 71.37 voters of the second generation to 100 of the first.

Such are the statistical data which may be of use to us in measuring the force of political privileges in assimilating different nationalities in this country. The process by which we shall study the use of these statistics belongs to the second part of this investigation.

TABLE VII.—SHOWING THE VOTING STRENGTH OF THE NATURALIZED FOREIGN BORN AND THE NATIVE BORN OF FOREIGN PARENTAGE.

	Relation Native Born Foreign Parentage Vote to Naturalized Vote.		Relation Native Born Foreign Parentage Vote to Naturalized Vote.
United States	84.45 to 100	North Central Division	79.45 to 100
North Atlantic Division	90.23 "	Ohio	155.30 "
		Indiana	130.36 "
Maine	127.84 "	Illinois	73.16 "
New Hampshire	74.48 "	Michigan	68.51 "
Vermont	139.30 "	Wisconsin	71.37 "
Massachusetts	88.78 "	Minnesota	46.96 "
Rhode Island	97.89 "	Iowa	82.13 "
Connecticut	82.96 "	Missouri	114.23 "
New York	86.51 "	North Dakota	43.30 "
New Jersey	74.20 "	South Dakota	59.45 "
Pennsylvania	102.34 "	Nebraska	62.55 "
		Kansas	83.48 "

THE REACTIVE INFLUENCE ON THE IMMIGRANT OF COMING TO THIS COUNTRY.

It would be of importance for our purpose if we could determine whether transplanting to this country modifies the characteristics of the foreign-born population. Such modification might render the process of assimilation easier, or it might be such as to render the influence of the foreign born much smaller.

These statistics are very difficult and uncertain. It is impossible to indicate here more than the general line of investigation.

The reactive influence may be either physiological, economic, or social.

THE PHYSIOLOGICAL influence should be seen in a change in the birth rates, death rates, marriage rates, or sickness or disease rates. No exact statistics show as yet any of these things for the foreign born. We have only indirect evidence. It seems to me probable that the foreign born have no excessive death rate after coming to this country. From the

Massachusetts Census it seems probable that the foreign-born married women have a larger number of children than the native-born married women, but that a greater proportion of them die.

Economic Effect. The economic effect of the change of condition is probably very great. Two lines of inquiry would seem to be profitable in this connection. One is that the immigrants change their occupations after coming to this country. The great mass of them when they come are unskilled laborers. Among the foreign born in 1880 34.89 per cent were engaged in manufactures and mechanical and mining industry, 13.15 per cent in trade and transportation, 28.62 per cent in professional and personal services. The second fact is that while the immigrants are largely from agricultural districts the foreign born in this country are, 44 13 per cent of them, found in large cities. This change from rural to urban life must have some effect, and this effect might be traced back for the different nationalities.

Social Effects. These can be traced out principally from the statistics of crime, pauperism, and illiteracy. I shall not enter into this subject except to say that from all the statistics the conclusion seems to be justified that criminality is somewhat more prevalent among the foreign born and those of foreign descent than among those of native descent, but this excess is not so great as to enable us to say that the influence of migration is to increase the tendency of crime.

TABLE VIII. — SHOWING PROPORTION OF FOREIGN-BORN ADULT PRISONERS AND OF FOREIGN-BORN ADULTS.

	Foreign-Born Male Prisoners of Total Male Prisoners.	Per Cent of Foreign-Born Males 18 Years of Age and Over of Total Males 18 Years of Age and Over.
United States	26.22	26.38
North Atlantic Division	31.69	32.21
South Atlantic Division	10.12	6.82
North Central Division	22.55	29.75
South Central Division	15.25	8.39
Western Division	32.18	36.07

The statistics of pauperism are more unfavorable to the foreign born, but this is natural considering that they are largely from among the lower classes.

The third division of this inquiry would be to trace the influence of the foreign born on the native American. Just as in the previous case, this influence might be such as to make the process of union easier, or it might be such as to render the influence of the native born much smaller.

These influences would, as in the previous case, be either physiological, economic, or social. The general line of inquiry would be the same, and in many cases the two inquiries would run into each other. This would be the case with the theory that immigration into this country has decreased the natural rate of growth among the native born. This can only be studied in connection with the previous question of the natural increase of the foreign born. So in the same way the economic influence is felt by the crowding in of the foreign born and the displacement of American labor. The effect of this may be either to drive American labor into higher occupations, or to force it to a lower plane of living. These inquiries are interesting and important. The statistics of pauperism do not seem to show that the competition of the foreign born has as yet had a fatal influence upon the natives. Social effects would require tracing out in the same way in the statistics of crime.

CONCLUSION.

It has been my intention to give in this paper simply an indication of the statistical data which I believe might be used to give us a better foundation for a theory of the mixture of nationalities and races than we yet have. I reserve for a second paper the consideration of what facts of observation should be brought into connection with these statistical data in order to give us the desired result. The method in this second part will be an investigation of the legislation and institutions of different states, with the view of ascertain-

ing if the varying proportion of the three elements of population which we have analyzed in this paper makes itself in any way felt. I have already, at various points in this paper, hinted at the way this comparison should be made, and I believe that we can already foreshadow certain general results as follows: —

(1) The process of assimilation is going on in this country, and is going on very effectually and rapidly, or else there would be differences between different communities, which would be obvious to the most superficial observation.

(2) Particular race or national character does not have a controlling and permanent influence on the institutions of this country, else we should find sections peopled by foreigners of different nationalities much more strongly marked by the peculiarities of those nationalities than we do.

(3) Physical environment does not seem to have an influence which can be distinctly traced on the institutions, except in the way of developing the same general character among the inhabitants, as mentioned in the introduction.

(4) The assimilating influences are principally social, that is, the influence of institutions already established, of the dominant language, and of the customs of the original inhabitants.

If these conclusions could in any degree be established, it would bring about an important modification in the sociological and philosophical theory of the influence of race character.

It would also have important practical consequences in teaching us what restrictions, if any, should be placed on immigration, and what influences should be especially encouraged for the purpose of developing a unified nationality in this country.

REPORT OF AN INTERNATIONAL MORTALITY STANDARD, OR MORTALITY INDEX.

By Joseph Körösi. (Budapest.)

1. *Disturbing Influence of Unequal Age Distribution on the Mortality Coefficient.*

The most correct standard of mortality is furnished by life tables, but on account of their intricacy they are seldom compiled. For ordinary statistical purposes the "death rate," although known to be inaccurate, is the usual measure of mortality; and every day we find, not only in newspapers, but also in scientific works, international comparisons of mortality based on these death rates.

The purpose of this paper is to determine whether it is possible to eliminate the errors connected with the usual calculation of the death rate, and thus to arrive at more reliable results.

The death rate gives the number of deaths among a certain number of inhabitants during the year.

Assuming that there occur 6000 deaths during a week in a country having ten millions of inhabitants, this would give for a year 312,000 deaths, and the death rate would be 31.2 per thousand inhabitants. If during another year, or in another country, this rate should rise to 40 per 1000, it would be generally assumed that the mortality had risen, and that by about one-third, the death rate being made use of to measure the sanitary conditions. This quality of the death rate could not be contested without denying all value to this standard. Wherefore establish a measure of mortality which is unable to measure it? But, although the same sanitary conditions exist in two localities, yet the death rate may be different. Take, for instance, two towns with 10,000 inhabitants each, A and B. If 10 per cent of the children and one per cent of the adults died in each of these towns during a

year, the sanitary conditions are the same in both places. And yet the death rate will differ as the number of children and adults differs, or, in other words, it will differ in accordance with the *distribution of ages.*

For instance, if A had 5000 children and 5000 adults, and B 2000 children and 8000 adults, the respective numbers of deaths would be as follows:—

	Children. Mortality 10 Per Cent.	Adults. Mortality 1 Per Cent.	Total.	
In A	500	50	550	55 per cent.
In B	200	80	280	28 " "

It will therefore be seen that the death rate not only depends upon the qualitative (sanitary) conditions of a country, which are the exclusively relevant ones, but is also influenced by a merely quantitative and thus quite irrelevant factor, that is, by the number of the more or less death-resisting elements. For it is evident that more children may be expected to die in a town in which their number is greater than in another* in which it is less, and that we therefore commit an error by confounding the frequency of deceased children with the greater vital danger of childhood.

2. *How to Eliminate the Influence of Unequal Age Distribution. (Standard Population.)*

If we take into consideration two towns with equal numbers of inhabitants, but differing in the number of children, it will at once be evident that in order to arrive at a correct estimate of the respective mortality in these towns the number of deaths, that is, the rough death rate, cannot be taken into consideration, but that we have to ask how this death rate would work out if the number of children had been the same in both. Common sense already tells us that a large number of children in a community points to a great vitality in its inhabitants, and that therefore if the death rate, as

* See page 305 of my Report at the Vienna session of this Institute, *Bulletin*, v. VI, Part 2.

shown in the case of A and B, gives a reverse result, this is irrational.

To arrive, therefore, at correct statistical results it is necessary to compare not the rough death rate of the total populations, but the special death rates of the various age classes. But in statistics it is necessary to represent the mortality of a whole country in *one* figure. It is not enough for us to know that in Paris, for instance, the mortality of children under one year of age is less than in London, that the mortality of children up to five years of age is greater, and that the age classes from 10 to 15 years are equally endangered in both cities, whilst the advancing classes of age present always differing relations. Such propositions, which partly contradict and neutralize one another, do not give us the desired information relative to the vitality of the total populations of these two cities, information which we justly expect from statistics.

At the last session of the International Statistical Institute I recommended a new method of calculation, which eliminates the influence of the various age classes by calculating the mortality within the several classes of age, but on the supposition that the age distribution in the localities to be compared was the same. Thus, the age distribution of A may serve as a basis (standard) for B, or *vice versa;* but we may even choose the distribution of a third locality, or the average distribution of the whole of Europe, as the standard distribution. This is the principal point in my proposal; the age classes to be chosen is a secondary consideration, and will be dealt with later on.

By a strange coincidence this same idea was brought before the session at the same time by Dr. Ogle, the eminent statistician of the English Registration Office. But on account of the novelty of the idea of a Standard Population, the Institute came to no decision, and resolved that a further report on the subject should be rendered at the next convention at Chicago. Only some time after the Vienna session it came

to my knowledge that Dr. Ogle had already perceived and applied the Standard Distribution in 1883,* and I am therefore bound and willing to acknowledge his priority, and will content myself with supporting his idea, and adding a few independent observations.†

3. *Calculation of Mortality Indices.*

I recommend that the death rate of the various age classes (the number of which will be discussed later on) be multiplied by the number of persons belonging to those age classes in the Standard Population, or, better still, by the figure representing the percentage of these age classes. This process produces new values, which I call Age Indices, in order to distinguish them from the Age Coefficient (death rate).

The age indices have this advantage over the coefficients, that they can be added. The sum of the age indices gives the general Mortality Index, which is uninfluenced by the varying distribution of age groups.

Let us assume that it was found desirable to distinguish the following 12 age classes, the percentage of which in the population selected as a standard (Sweden) was as follows: —

0 to 1 years, . . .	2.65 per cent.	10 to 20 years, . . .	19.54 per cent.
1 to 2 " . . .	2.49 "	20 to 30 " . . .	15.63 "
2 to 3 " . . .	2.49 "	30 to 40 " . . .	12.26 "
3 to 4 " . . .	2.32 "	40 to 50 " . . .	10.73 "
4 to 5 " . . .	2.35 "	50 to 60 " . . .	9.32 "
5 to 10 " . . .	10.62 "	Over 60 " . . .	9.60 "
		Total of Standard Population, . . .	100.00 per cent.

Now to apply these ratios to Austria (1881) the following calculations would be necessary: —

1. Calculate the special death rate for each of the 12 age classes.

* Dr. Koch, the Director of the Statistical Office in Hamburg, informs me that as far back as 1883 he had also used the standard calculation, as can be seen on page 44 of the 12th part of the *Statistik des Hamburgischen Staates*. It gives us satisfaction to see that the reasons which our esteemed colleague adduced ten years ago for the necessity of a standard distribution agree almost word for word with ours.

† See also my first paper in the *Bulletin*, Vol. VI. chap. 2.

2. Apply these 12 death rates to the respective figures of the age classes of the standard population, which will produce 12 age indices.

3. By adding the age indices you obtain the general Mortality Index.

a. CALCULATION OF DEATH RATES FOR 12 AGE CLASSES.

Age.	Living on Dec. 31, 1880.	Died, 1881.	Death Rate. Per Cent.
0 to 1	679,458	208,357	306.7
1 to 2	588,521	52,635	89.4
2 to 3	561,479	27,640	49.2
3 to 4	542,773	18,267	33.7
4 to 5	542,599	14,466	26.7
0 to 5	2,914,830	321,365	110.3
5 to 10	2,421,696	30,664	12.7
10 to 20	4,277,867	25,901	6.1
20 to 30	3,588,816	32,610	9.1
30 to 40	2,969,307	34,772	11.7
40 to 50	2,450,404	41,336	16.9
50 to 60	1,838,486	52,381	28.5
Over 60	1,682,838	137,266	81.6
Unknown	.....	220	.....
Total,	22,144,244	676,515	30.6

b. CALCULATION OF MORTALITY INDEX BASED ON THE ASSUMED NORMAL DISTRIBUTION OF AGE CLASSES.

Age Class.	Death Rate.	Standard Distribution.	Died. Per Cent.
0 to 1	306.7	2.65	8.13
1 to 2	89.4	2.49	2.23
2 to 3	49.2	2.49	1.23
3 to 4	33.7	2.32	0.78
4 to 5	26.7	2.35	0.62
0 to 5	110.3	12.30	13.57
5 to 10	12.7	10.62	1.35
10 to 20	6.1	19.54	1.19
20 to 30	9.1	15.63	1.42
30 to 40	11.7	12.26	1.43
40 to 50	16.9	10.73	1.81
50 to 60	28.5	9.32	2.66
Over 60	81.6	9.60	7.83
Total,	30.6	100.00	31.26

It now only remains to answer the following two questions:

(1) How many age classes should be used, *i.e.*, how many death rates should be calculated?

(2) Which age distribution should be used as a standard?

4. *From what Number of Elements should the Mortality Index be Calculated?*

In my report addressed to the Vienna meeting I gave the results of my endeavors to arrive at the difference in the index caused in several countries by various limitations of the age groups. The first calculation was made for 12 groups, viz., the first five years of life in five groups, 5 to 10 years in one group, and the higher age classes in six groups of 10 years each.

The following simplified methods were then tried:—

The first year was calculated separately, and 2 to 5 years taken as one group; the first five years were taken as one group; the ages from 5 to 20 years formed another group; and, finally, the higher age classes were arranged in five groups of 10 years each, and again in three groups of 20 years each.

From these calculations it was found to be preferable to group the first year separately, but there was no sensible change produced by placing the next 19 years (20 inclusive) in a single second group. In the ages over 20 years no difference in the mortality index was appreciable if for the numerous 10-year groups two larger groups, one comprising the ages from 20 to 50, and the other those over 50, were substituted. Regarding especially the more advanced classes (over 60 years) it was found that, in consequence of their drifting number, they may be unhesitatingly united with the class of 50–60. It is therefore evident that, as the results are almost identical if the above four groups are used, (viz., 0–1, 1–20, 20–50, and above 50 years) instead of 12, the former quicker method should be preferred, especially

when monthly, or even weekly, calculations for several countries or towns have to be made.*

The admissibility of the different age limitations may be judged by the measure in which a change of age groups influences the succession. In the following 14 countries, it will be seen that, taking only four age death rates into consideration, the succession of these countries is almost identical with that resulting from 12 death rates, as shown in the table: —

	(*a*) 12 Death Rates.	(*b*) 4 Death Rates.
Sweden	1	1
Norway	2	2
Denmark	3	3
Scotland	4	4
Belgium	5	5
France	6	7
Netherlands	7	6
Switzerland	8	8
Prussia	9	9
Wurtemberg	10	10
Saxony	11	11
Bavaria	12	13
Italy	13	12
Austria (Cisleithania)	14	14

Thus the easiest calculation (that with four elements) did not cause more than two displacements, and even these of only one degree each.†

Dr. Ogle proposes an age distribution of 12 groups, subdivided according to sex, which would require 24 calculations. This increase of labor could only be justified if the result differed materially from that obtained by the simpler and quicker method. But such not being the case, and the

* The *International Weekly Bulletin*, edited by Dr. Janssens (Brussels), gives 250 towns. The usual calculation of one death rate for each town would require 250 calculations per week, and 6250 per annum. The introduction of a mortality index derived from four elements would quadruple the number of operations, and bring them to 25,800, whilst the introduction of 12 age classes would bring the number up to 75,000. Should Dr. Ogle's plan of separating the classes into two sex classes be adopted, the number of calculations required would rise to 150,000, which would hardly be feasible.

† In order to prove the sufficiency of the easiest method (with four elements), let us take the index of Sweden as 100; I will at the same time refer to the amendment proposed by Dr. Bertillon in the Committee of the Vienna Conference (*Bulletin*, Vol. VI, Part 1, page 36). He agreed to the index calculation in principle, and also accepted the above mentioned four age groups, but proposed that, on account of the greater mortality in the highest age classes, a fifth should be added for those over 60 years of age. This proposition ought to be respected, in case that the establishment of a fifth group influences the result; if

difference of the mortality of the two sexes being not great enough to compensate for the heavy increase of labor, I hope Dr. Ogle will qualify his recommendation, at least for cases in which it is essential to arrive quickly at a fairly reliable result.

5. *Use of the Standard Distribution for other Purposes.*

It must be mentioned that Dr. Ogle goes further than I in the application of the standard distribution, as he uses it not only for the calculation of the mortality index, but also for that of births and marriages.

Although these points are beyond the scope of my paper, which only pretends to deal with the death rate, yet in connection with the above I may be allowed to offer some brief remarks upon this topic. The distribution of ages is of im-

not, we ought to prefer the easier method. In order to show the working of this amendment, I give below a table from which will be seen the difference resulting from Dr. Bertillon's amendment. (See my paper in the *Bulletin*, page 305r, lib. C.)

MORTALITY INDEX OF 14 COUNTRIES, TAKING THAT OF SWEDEN AS 100.

	(*a*) 12 Death Rate.	(*b*) 4 Death Rate.	(*c*) Bertillon. (5 Death Rate.)	Difference Between *b* and *c*.
Sweden	100 (1)	100 (1)	100 (1)	0.0 per cent.
Norway	108 (2)	108 (2)	108 (2)	0.0 "
Denmark	114 (3)	116 (3)	115 (3)	0.9 "
Scotland	115 (4)	116 (4)	115 (4)	0.9 "
Belgium	120 (5)	121 (5)	119 (5)	1.7 "
France	127 (6)	130 (6)	129 (7)	0.8 "
Netherlands	130 (7)	130 (7)	127 (6)	2.3 "
Switzerland	131 (8)	130 (8)	131 (8)	0.8 "
Prussia	144 (9)	144 (9)	143 (9)	0.7 "
Wurtemberg	151 (10)	153 (10)	151 (10)	1.3 "
Saxony	158 (11)	157 (11)	159 (13)	1.3 "
Bavaria	158 (12)	159 (13)	155 (11)	2.5 "
Italy	160 (13)	158 (12)	158 (12)	0.0 "
Austria	175 (14)	173 (14)	173 (14)	0.0 "

It will be seen that the 4-element calculation only differs from that of the 12-element by about 2 per cent, giving for a country whose mortality index is 30 per cent an index of between 29½ to 30½ per thousand, a difference which is without any importance, if it is the question to establish a quick and easy calculation of a fairly valuable measure of the mortality. It is also seen that the amendment of Dr. Bertillon causes a still weaker influence.

portance not only for the facts already quoted, but for nearly all phenomena of social life. The criminality of a country, for instance, depends also upon the number of those persons who, on account of their age, are able to commit crimes, and the much lamented larger rate of criminality of large cities is caused to a considerable extent by the simple fact that the age classes which contribute to it are more numerous there than in the villages. Similar difficulties present themselves in the statistics of professions, because here also the number of unemployed depends to a certain extent upon the number of infants and aged people. Therefore in almost all statistical calculations the age distribution has lately been taken into account. Thus, Bertillon (Senior) has proposed to calculate the births coefficient not from the total number of inhabitants, but from those at the age of puberty; in criminal statistics the coefficient of criminality is obtained from the number of people of the age classes which can be made accountable for crime, and some of them are even limited to the male or female portion of a population, as in military crimes or abortion.

But it is not possible to make a general rule as to the limitation of age classes in the various statistical problems. This will have to be considered for each case. So, for instance, in calculating the death rate, different age classes will have to be considered than in marriage or birth statistics. Dr. Ogle proposes for these the same standard distribution as for the mortality (0 to 5, to 10, to 15, etc.); but it appears clear that in calculating the marriage and birth rates the classes from 0 to 15 should be omitted, and for the birth rate, those also in the three classes from 65 years upwards. By omitting these six classes, Dr. Ogle's 12 classes will already be reduced to six, and a further reduction appears to me feasible.

6. *Selection of the Standard Population.*

It now remains to select the population whose age distribution shall be selected as a standard.

In my previous paper I have carried out calculations based on two standard distributions, that of Sweden and that of 14 European states, and it was found (see page 305r) that the order in which the mortality indices of the several countries succeed was almost identical in the two series of calculations. It appears advisable to adopt the simpler, *i. e.*, that based on the distribution in *one* country.* This, especially with only

* Dr. Bleicher, Director of the Communal Statistical Office, at Frankfurt a. m., has submitted a very searching critique of the standard and index calculation to the eighth conference of German Communal Statisticians, and, because the index changes as one or another age distribution is used as a standard, he came to the conclusion to adhere to the old death-rate calculation, at any rate not to abandon it altogether. The latter was never intended; no country can, for its own use, do without the mortality coefficient. But it is another question whether the death rate is suitable for international purposes. If it can be proved that the old coefficient furnishes a correct measure of international mortality, and that this measure is not altered by the different age distributions, there is, indeed, no reason for introducing a new method. But if we think that the death rate furnishes no reliable measure of the mortality,—and I venture to say that scientific literature occupies a hostile position towards this measure,—then it follows necessarily that a new method must be adopted, which is free from the faults pointed out. And this is the sole object of the proposition of Dr. Ogle and myself. As to the objection that the modification of the standard ages exercises too great an influence on the measure of mortality, that is a question of facts, which may be easily verified. I refer in this respect to my first paper, where the indices have been calculated on the base of two different standard populations. The one was taken from 4½ millions of inhabitants of Sweden, the other from the different average of 14 European countries with not less than 225 millions of inhabitants. Let us now see how in the two results the succession and the distance of the mortality indices changes. Assuming the mortality of the first country (Sweden) as 100, the others stand in the following order:—

	Standard: (*a*) 223 Millions of the European States.	Standard: (*b*) 4½ Millions of Sweden.	Difference. Per Cent.
Sweden	100 (1)	100 (1)	0.0
Norway	108 (2)	108 (2)	0.0
Scotland	116 (3)	116 (3)	0.0
Denmark	117 (4)	116 (4)	0.9
Belgium	121 (5)	121 (5)	0.0
France	131 (6)	130 (6)	0.8
Netherlands	131 (7)	130 (7)	0.8
Switzerland	131 (8)	130 (8)	0.8
Prussia	145 (9)	144 (9)	0.7
Wurtemberg	155 (10)	153 (10)	1.3
Saxony	159 (11)	157 (11)	1.3
Italy	159 (12)	158 (12)	0.6
Bavaria	164 (13)	159 (13)	3.0
Austria	174 (14)	173 (14)	0.6

It will be seen (1) that, although the two standards are so vastly different, the order of the countries remained absolutely the same; (2) that the distance of the indices suffered

four age classes, could be calculated in a few minutes, whilst the other — as contained at the pages 305 *a–l* of my paper — represents the work of several days. Further, the census in the several European states is not taken simultaneously, and every statistician would therefore select a different country for his standard, and, unless one of the statistical offices is entrusted with the task of calculating and publishing the table of European standard, a uniformity of coefficients and indices will be impossible.

For these reasons, and on account of the eminent position occupied by Sweden relative to mortality statistics and census of population, I proposed to accept the age distribution of that country as the standard.

7. *Resolutions.*

As Dr. Ogle in his report has only given general indications of the new plan of calculation, without establishing any rules for its use, and as further he has not stated which age distribution should be accepted as the standard, I have to revert to the resolutions formulated in my first paper.

Although from Dr. Ogle's propositions it cannot be seen how far his harmonizes with mine,* yet this is possible by the actual calculations which are found in his other books. In the publications of the English Registration Office our esteemed colleague uses two standard calculations, one in the Annual Reports of that office, and the other in the Annual

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only very slight variations; this distance changed in nine cases scarcely by 1 per cent, remained quite the same in three cases, and was altered only in one case by 3 per cent. The small variations shown above do not warrant the rejection of a theoretically more correct measure of mortality. In face of the approximative value of all measures of mortality there must be finally found a limit beyond which we could not persist in attributing any weight to claims against inaccuracy.

* *Bulletin*, Vol. VI, 1, pages 83 to 85, the proposal of Dr. Ogle is verbatim as follows: "I think it would be highly desirable to select, at any rate for purposes of international statistics, a standard population of fixed age and sex distribution, and to ask the officials in each country, who are charged with the statistics of mortality, to give each year in their reports the death rate for their country as it would have been had the population agreed in its composition with the international standard."

Summaries of Births, Deaths, and Causes of Deaths in London.*

The calculation used in the Annual Report corresponds entirely with that recommended by me. I therefore beg that my propositions should be considered only as amendments to a method which has been used by Dr. Ogle for some time previous to my proposals.

As regards the second method, however, I am sorry to say that I cannot agree with it, and since I have given my reasons more extensively (on pages 305, etc.) of my first paper, I will only here mention that Dr. Ogle's method brings us back again to the death rate, and any difference between the rough and the corrected death rate appearing in his calculations would not be the result of an intentional correction, but of an erroneous average calculation. If we eliminate this error, we are again before the rough death rate, which we intended to correct.

I therefore propose the following resolutions: —

Resolved: 1. In order to obtain a measure of mortality suitable for international purposes, *i. e.*, which will not be influenced by different age distributions in different countries, it is recommended to adopt Dr. Ogle's method, which reduces all age distributions to one standard distribution.

2. In order to obtain a rapid and yet sufficiently reliable result it is sufficient to calculate the death rates for the following four age classes, viz., 0 to 1, 1 to 20, 20 to 50, and upwards of 50.

Recommended: 3. That the age distribution of only one country, for instance, that of Sweden, be adopted as a standard.

4. The new international mortality measure, here called the mortality index, be obtained by multiplying the death rates of the above four age classes by the figures representing the percentage of these age classes in the standard population. The result will be four age indices corresponding with the four age classes, which when added will give the Total Index, or, in other words, the international measure of mortality for the total population.

* The process under consideration is fully given in the Annual Summary for 1883 (quoted verbatim in my Report, on page 305 *y*). A full explanation of this method will also be found in Newsholme's *The Elements of Vital Statistics* (London, 1889).

5. The number of living is, in accordance with existing resolutions, to be calculated yearly on the basis of the difference between the numbers obtained at the two last censuses, and to be taken for the middle of each year. The standard distribution for the ten years elapsing between the general enumerations is to remain unaltered.

EXPERIMENTAL TABLE FOR AUSTRIA (CISLEITHANIA).

Age Group.	Standard Ages (Sweden, 1880).	Death Rate in Austria, 1881.	Mortality Index.
0 to 1	2.65 per cent.	30.67 per cent.	8.13 per cent.
1 to 20	39.81 "	1.90 "	7.56 "
20 to 50	38.62 "	1.20 "	4.63 "
Over 50	18.92 "	5.39 "	10.20 "
Total.	100.00 per cent.	.....	30.52 per cent.

CHARACTER AND VOLUME OF THE MONEY OF THE UNITED STATES.

By Maurice L. Muhleman.

The accompanying statistics, relating to the monetary stock of the United States, its character, volume, and movement, are presented for the purpose of reviewing the movement since the silver legislation of 1878, and directing attention to certain facts, shown by the movement, bearing upon the currency question in general. Furthermore, the presentation in this form may afford additional material for the further prosecution of the inquiry into the operation of the law governing the demand and supply of currency (particularly with reference to the smaller denominations), which, at this time, is a subject of the first importance, bearing, as it does, upon the question how much silver can be absorbed into our circulation.

Omitting from consideration the minor coinage (of nickel and bronze), we have to deal with nine species of "money," of which three are metallic and six paper.

I. Gold Coin (including bullion in the Treasury not yet coined).
II. Silver Dollars, coined at the ratio of 15.988 (say 16) to 1 of gold.
III. Subsidiary Silver Coin, coined at the ratio of 15½ to 1 of gold.
IV. Gold Certificates, issued upon specific deposits of gold coin.
V. Silver certificates, issued upon specific deposits of silver dollars.
VI. United States Notes, issued on the credit of the Government, but since 1879 always redeemable in gold coin on demand.
VII. Currency Certificates, issued, in large denominations only, upon specific deposits of United States notes.
VIII. Treasury Notes of 1890, issued on the credit of the Government to pay for monthly bullion purchases.
IX. National Bank Notes, issued by banks upon deposits of bonds in the Treasury.

Of the above, Gold Coin, Silver Dollars, United States Notes and Treasury Notes of 1890, are legal tenders for any amount; Subsidiary Silver Coin to the extent of ten dollars. Gold Certificates and Silver Certificates are not legal tenders, but are receivable for all Government purposes. Currency Certificates and National Bank Notes are not legal tenders, but the latter are receivable for public dues, with the exception of duties on imports and interest on the public debt.

With the exception of National Bank Notes and Subsidiary Silver Coin, all of the kinds of money enumerated are available for the reserves of national banks.

The first table shows the amount belonging to the Treasury and that on deposit only for which certificates are in circulation; the second table shows the amount of each kind of money composing the entire stock; the third and fourth, composition of the money in circulation and that in the Treasury, respectively; the fifth gives the effective circulation, arrived at by deducting from the aggregate stock the amount deposited in the Treasury against which certificates are in circulation, and which is duplicated in the official reports of the entire stock; also the *per capita* of the entire circulation owned by the Treasury and effective circulation.

The four following tables show the denominations of several issues of paper money and proportion of small notes (from $1 to $20, inclusive), and the large.

The tenth table gives an approximate estimate of the "retail money," made up of the small notes, silver dollars, and subsidiary coin in circulation; the amount of the *per capita*, and the relation the amounts bear to the total effective circulation. Furthermore, there is given a tentative estimate of the gold coin in circulation.

The final table shows the bonded debt, the production and movement of gold and silver.

The movement in the monetary stock, as shown by the tables, was, for the period, as follows: —

End of Fiscal Year.	Entire Stock.	Metal.	Paper.	In Circulation.	In the Treasury.	Belonging to Treasury.	On Deposit Only.
1878	1,034*	301	763	807	257	164	93
1886	1,823	903	920	1,249	574	309	265
1893	2,317	1,207	1,110	1,594	723	139	584

It appears, therefore, that the aggregate stock increased more than 117 per cent, while the population, estimated at 48 millions in 1878, and at 67 millions in 1893, shows an increase of only 37½ per cent. The amount in circulation, however, increased something less than 100 per cent; and if we consider only the effective stock, which in 1878 was (807 + 164) 971 millions, and in 1893 (1594 + 139), 1733 millions, the proportion of increase was only about 68 per cent. The money in the Treasury, and belonging to it, being used in its daily transactions, is here properly included as effective circulation.

Examination of the character of the increase shows that it has been chiefly in gold and silver and the representative paper issues (including the Treasury notes issued for bullion), the only decrease having been in the national bank notes.

The gold stock appears to have increased 379 millions, of which 319 millions is in the amount supposed to be in circulation. This estimate of the gold stock has been questioned by many writers, and by the more conservative is believed to be fully 100 millions less than represented by the official statistics. If, then, the effective circulation be reduced by reducing the gold coin estimated as in circulation, it seems probable that the effective circulation is not much above 1600 millions, which would indicate an increase of about 65 per cent since 1878.

The amount *per capita* for 1878 appears to have been about $20.23 of effective circulation, and for 1893 about $25.86; the amount in actual circulation appears to have been $16.81 in 1878, and $23.79 in 1893, after making the deduction in

* The figures represent millions of dollars.

gold coin the net circulation was $16.25 and $22.12, and the net effective stock $19.67 and $24.19, respectively. In the table exhibiting this feature a tendency to a *per capita* of about $21 seems to impress itself on the observer. The years from 1886 to 1888, during which the surplus in the Treasury rose to very high figures, curtailing somewhat the circulation performing the active work, show the deviation to a lower, followed by a higher, ratio; it was during the beginning of this period that the silver stock of the Treasury (and therefore of the country) appears to have been relatively redundant. But the issue of small silver notes authorized in 1886, and coming into use the following years, relieved the situation of the threatened peril of such a surplus.

Turning now to the tables showing the denominations of the paper issues we find the following changes: — *

End of Fiscal Year.	1's and 2's.	5's.	10's.	20's.	Total Small.	50's and 100's.	Large.	Total Large.
1878	49	149	169	130	497	110	156	266
1886	36	169	218	185	608	140	173	313
1893	71	244	299	230	844	119	147	266

It is evident that in 1886 the supply of small notes was not only relatively (to the large) but also absolutely insufficient; and here is where the demand for the further issue of 1's, 2's, and 5's (finally granted after a vain attempt to force into circulation the silver dollars) made itself felt. Even now (before the abnormal stringency of July and August of the present year) the demand for the four minor denominations is not satisfied, and certainly 50 millions, possibly much more, could be added to the present stock of these denominations.

From the tables it is evident that fully 75 per cent of the paper circulation has been, in normal years, in these smaller denominations; and that 85 per cent, constituting nearly 60 per cent of the total effective money, might be in such notes. This, it will be observed, is entirely without considering the gold coin (which is all in small denominations), or the silver actually outside of the Treasury.

* The figures represent millions of dollars.

In the following table the "retail money," composed of the small notes, plus the silver dollars and subsidiary coins in circulation, is shown. These forms of money have increased as follows: —*

Fiscal Year.	Gold Certificates.	Silver Certificates.	U. S. Notes.	Treasury Notes.	National Bank Notes.	Silver Dollars.	Subsidiary Coin.	Total.
1878	..	...	224	...	273	1	65	563
1886	12	95	243	...	258	53	46	707
1893	9	296	261	127	151	57	65	966

The amount of retail money *per capita* was, in 1878, $11.74; in 1886, $12.40; and, in 1893, $14.42.

The amounts of the large denominations, which may, for convenience in distinguishing, be termed "wholesale" or "banking" money, were composed, as will be observed by reference to the tables, chiefly of Gold Certificates and United States Notes, and the Certificates issued upon deposits of the latter; Silver Certificates and National Bank Notes have long ago ceased to play an important part in the larger transactions.

The experience of 1886, and the satisfactory remedy then applied, would appear to indicate a means by which the silver stock (now feared by so many as a destructive element), constituting as it does, directly and indirectly, about one-third of our effective circulation, could be readily absorbed, provided its acquisition be suspended, as appears probable will be done before long. In other words, our "retail money" could with perfect safety be composed of silver paper issues; the only remaining elements of the problem being (1) to arrive at a satisfactory figure of the *per capita* requirements of the country; (2) to provide for the ready absorption of the surplus of such notes, which regularly presents itself, particularly in the city of New York, when the active business operations, resulting from the periodical crop movements, have been performed.

From January to June of each year the steady current of small notes from the West to the East, interrupted for only a

* The figures represent millions of dollars.

very short period in March, threatens to swamp the capacity of the banks in that city and of the Treasury to absorb; useless for the time being in the West, they become a positive burden in the East, until again needed for the crop movement, beginning usually about August 1st.

If the persistent recurrence in years of normal business of the amount of $21 *per capita* indicates the currency need, and if the retail requirement represents more than half of the circulation, have we not perhaps a key to the determination of the questions of volume? and with that of the absorption of our silver stock?

If in the past few years the supply of money has been redundant, as may be reasonably inferred from our losses of gold, is it not, nevertheless, probable that if we had had only the allotted amount, our silver would not have caused the gold loss? In other words, if we had had only the proportion of silver called for by our normal needs, would a loss of gold have been properly attributable to silver?

It would then remain only to provide a convenient and satisfactory form of "bank money" into which the "retail money" could be converted to provide for the annual ebb and flow of small notes.

It is to be hoped that wise legislation may ere long bring about greater homogeneity, as well as security, in our currency system.

The accompanying tables, abstracted from the others, illustrate the principal points.

I. TABLE SHOWING THE ENTIRE STOCK, ITS COMPOSITION AND DISTRIBUTION.

Fiscal Year Ending June 30.	The Entire Stock.										In the Treasury.		In Circulation.	Deduct for Over-Estimate of Gold.	Net in Circulation.	Net Effective Circulation.	*Per Capita.*	
	Gold Coin and Bullion.	Silver Dollars and Bullion.	Subsidiary Silver Coin.	Gold Certificates.	Silver Certificates.	United States Notes.	Treasury Notes of 1890.	National Bank Notes.	Currency Certificates.	Total.	On Deposit Only.	Owned by Treasury.					Of Net Circulation.	Of Net Effective.
1878	213	16	72	44	2	347	....	325	47	1,064	93	164	807	27	780	944	$16.25	$19.67
1879	246	41	76	15	3	347	....	329	31	1,088	49	215	824	35	789	1,004	16.10	20.49
1880	352	69	79	8	12	347	....	344	14	1,225	35	212	978	43	935	1,147	18.70	22.94
1881	478	95	80	6	51	347	....	354	12	1,423	69	235	1,119	52	1,067	1,302	20.92	25.53
1882	507	122	80	5	67	347	....	357	13	1,498	85	235	1,178	63	1,115	1,356	21.44	25.96
1883	543	152	81	82	89	347	....	356	13	1,663	184	242	1,236	76	1,160	1,402	21.48	25.96
1884	545	179	75	98	121	347	....	339	12	1,716	231	243	1,242	82	1,160	1,403	21.09	25.51
1885	589	208	75	140	140	347	....	317	29	1,845	310	245	1,290	89	1,201	1,446	21.44	25.82
1886	591	237	75	131	116	347	....	308	18	1,823	265	309	1,249	91	1,158	1,467	20.32	25.74
1887	655	278	75	121	146	347	....	279	9	1,910	276	317	1,317	96	1,221	1,538	20.70	26.07
1888	706	310	76	142	229	347	....	252	15	2,077	386	319	1,372	100	1,272	1,591	20.20	26.52
1889	680	344	76	154	263	347	....	211	17	2,092	434	278	1,380	104	1,276	1,554	20.91	25 47
1890	695	380	77	157	302	347	....	186	12	2,156	471	256	1,429	107	1,322	1,578	20.99	25.05
1891	647	437	78	152	314	347	50	167	24	2,216	540	177	1,499	109	1,390	1,567	21.72	24.49
1892	664	491	77	157	332	347	101	172	30	2,371	620	148	1,603	100	1,494	1,642	22.64	24.88
1893	592	538	77	94	331	347	147	179	12	2,317	584	139	1,594	112	1,482	1,621	22.12	24.19

NOTE.—Amounts are always given in the nearest millions of dollars.

II. TABLE SHOWING "RETAIL MONEY," ITS COMPOSITION AND AMOUNT *PER CAPITA.*

Fiscal Year Ending June 30.	Large Denominations of Paper.	Small Denominations of Paper.				Composition of Small Denominations.					Total Small Denominations.	*Per Capita* of Small.	Silver Dollars in Circulation.	Subsidiary Silver in Circulation.	Total Silver Coin.	*Per Capita* of Silver.	Total Retail Money.	*Per Capita.*
		1's and 2's.	5's.	10's.	20's.	Gold Certificates.	Silver Certificates.	United States Notes.	Treasury Notes of 1890.	National Bank Notes.								
1878	266	49	149	169	131	....	....	224	....	273	497	$10.36	1	65	66	$1.38	563	$11.74
1879	230	43	150	171	131	....	....	215	....	280	495	10.10	8	67	75	1.53	570	11.63
1880	175	45	166	191	149	....	4	253	....	293	550	11.00	19	55	74	1.48	624	12.48
1881	167	48	169	216	169	....	38	264	....	301	603	11.82	29	53	82	1.61	685	13.43
1882	173	52	165	223	176	....	54	259	....	303	616	11.84	32	52	84	1.62	700	13.46
1883	248	54	165	230	190	9	72	260	....	298	639	11.83	35	52	87	1.61	726	13.44
1884	272	52	163	230	200	13	96	254	....	282	645	11.73	40	46	86	1.56	731	13.29
1885	349	51	157	221	195	12	104	246	....	262	624	11.14	38	44	82	1.46	706	12.60
1886	313	36	169	218	185	12	95	243	....	258	608	10.66	53	46	99	1.74	707	12.40
1887	263	41	181	226	191	11	135	257	....	236	640	10.85	55	49	104	1.76	744	12.61
1888	275	55	205	248	201	13	221	262	....	214	710	11.83	56	50	106	1.77	816	13.60
1889	301	55	203	242	191	11	256	245	....	179	691	11.33	54	51	105	1.72	796	13.05
1890	276	60	212	261	195	12	293	266	....	157	728	11.55	56	54	110	1.75	838	13.30
1891	290	61	225	272	206	14	297	274	37	142	764	11.94	58	58	116	1.81	880	13.75
1892	326	65	237	288	222	12	302	274	79	146	813	12.32	57	62	119	1.80	932	14.12
1893	266	71	244	299	230	9	296	261	127	151	844	12.60	57	65	122	1.82	966	14.42

NOTE.—Amounts are always given in the nearest millions of dollars.

FLUCTUATIONS IN THE SECURED CIRCULATION OF THE NATIONAL BANKS AND THEIR RELATIONS TO THE PRICES AND INVESTMENT VALUES OF BONDS.

By Charles A. Conant.

Against the national banking system there has always been the complaint of the opponents of the system that the banks were able to draw "double interest," because they received the interest on their bonds while making a profit by the loan of the currency based upon the bonds.

The criticism was strongest, perhaps, at the very moment when the banks began to find circulation unprofitable. The familiar rule of all financial speculations, that valuable securities become less profitable than more hazardous ones because of the high premium at which they sell, operated in the case of the United States bonds. The resumption of specie payments, the adherence to the policy of paying interest in gold, and the undoubted credit of the government, made "the bond-holder" an envied individual, but it also made the holding of the bonds as a permanent investment less profitable than the sale of them while the price was high.

Every year that brought the bond nearer to maturity lessened the selling price, and made it more desirable, up to a certain time, for the alert financier to dispose of his property at a premium rather than hold it drawing a moderate rate of interest until he should be obliged to accept its bare face value on the date of its maturity. It became a simple mathematical proposition for the national banks whether it were more profitable to market the bonds and lose the small profit on circulation or to retain them and lose the benefit of their high prices. The question was substantially the same, as a mere abstract question of mathematics, whether a bank

already owned the bonds or whether a new corporation went into the market to buy them. What the new bank was obliged to pay the old bank was losing by failing to sell. How futile even the charm of "double interest" proved against the temptation of better-paying investments, and how the national bank-note circulation changed with changed conditions, I have endeavored to show at a glance in the following summary table of the state of the banks and the bond market for a series of years: —

Date.	Authorized Capital Stock.	Circulation Secured by Bonds.	4 Per Cent Bonds. Price.	Investment Value.
1882. January.	$470,018,135	$332,398,922	117.75	3.008
July.	486,511,335	320,312,832	119.12	2.922
1883. January.	492,076,635	322,386,120	119.62	2.901
July.	507,208,135	319,249,896	119.12	2.926
1884. January.	518,031,135	310,953,321	123.75	2.665
July.	528,784,165	299,369,370	118.75	2.918
1885. January.	529,910,165	285,496,055	121.90	2.726
July.	531,540,465	279,528,175	122.64	2.668
1886. January.	534,378,265	274,466,748	123.43	2.607
July.	545,206,565	247,087 961	126.49	2.420
1887. January.	555,865,165	205,316,106	127.83	2.320
July.	574,703,665	171,629,341	127.84	2.284
1888. January.	584,726,915	165,205,724	126.12	2.341
July.	592,852,915	159,642,657	127.48	2.230
1889. January.	598,239,065	146,372,588	127.29	2.208
July.	609,670,365	132,244,437	128.38	2.109
1890. January.	623,791,365	127,742,440	125 61	2.236
July.	646,937,865	129,767,150	122.32	2.407
1891. January.	665,2 7,865	125,660,361	120.92	2.463
July.	676,247,865	127,221,391	117.33	2.676
1892. January.	685,762,265	140,084,203	116.67	2.693
July.	692,123,665	145,683,023	116.45	2.677
1893. January.	.....	150,526,651	114.00	2.864
July.	.....	157,901,099	109.75	3.179

The essential feature of the table is that the secured circulation of the national banks has until the last two years been steadily diminishing as the investment value of the bonds declined. The national banking act requires a minimum deposit proportioned to the capital stock of the institu-

tion, so that no bank, without going out of business, could dispose of its entire holdings of bonds; yet so general was the movement to retire circulation which had become unprofitable and dispose of the bonds that the reports to the Comptroller of the Currency for October 2, 1890, showed that out of a total sum of $139,969,050 in bond deposits $101,247,615 was required by law, and only $38,721,435 was voluntarily on deposit to obtain the benefit of additional circulation.

The maximum secured circulation of the national banks of the country, after the redemption of specie payments, was reached in January, 1882, and the amount showed no tendency to increase for nine years after that date. The fall was slow until the beginning of 1884, in which year it averaged about $2,000,000 per month. The process of reduction was somewhat arrested during the next year, only to advance at a greatly quickened pace in 1886. The decline of circulation secured by bonds was from $274,466,748 on January 1, 1886, to $205,316,106 on January 1, 1887, an average decline of nearly $6,000,000 per month. The volume of outstanding circulation secured by bonds was now so reduced that the aggregate decline year by year was smaller, but the rate of decline continued nearly as great as before until the year 1890, when a comparatively stationary point was reached.

The striking fact about the decrease in secured circulation down to 1891 is that it has not been accompanied by any decrease in the number of national banks or in their aggregate capital stock. The organization of new institutions for the purpose of banking, exclusive of large issues of circulation notes, has gone steadily on while the older banks have been retiring their circulation. Not since 1879 has there been any decrease in the number of national banks. The net increase in the number of banks in the year ending October 31, 1880, was 45, and in 1883 the number was 220. This number was not reached again until 1890, when the net

increase was 248. It has been less for the three years which have followed, but the number of banks on October 31, 1892, was 3,738, and the aggregate capital was $693,868,665.

The sensitiveness of the banking interest to changed conditions, and the element of elasticity which bank-note circulation is capable of adding to the currency have been most strikingly shown within the past year. There was some increase in the circulation, based upon bonds during the two years since August, 1891, but this increase was only $9,000,000 during the last five months of 1891, and only $12.000,000 more during the next year, to January, 1893. The increase during the first half of the present year, also, was only $7,374,448, but July and August have shown a wonderful expansion. The increase in circulation secured by bonds was $5,320,194 during July, and has already been $6,784,835 during the first fifteen days of August. The latter figure is that of the notes actually issued. The bonds deposited to obtain new circulation have reached the amount of $14,452,-550, and the orders for new bank notes, for which bonds will be deposited when the notes are printed, if they have not already been, reach the almost unprecedented amount of $25.511,450 for fifteen days.

The turning point in the aggregate circulation did not come as quickly as in the circulation based upon bonds, because of the reduction going on in the dead circulation which was in process of retirement while the live circulation secured by bonds was on the increase. The cancellations having come nearly to a standstill, the increased issue of live circulation shows in the totals, and these figures have advanced from $178,614,535 on July 1st to $183,655,920 on August 1st, and $190,193,462 on August 15th.

The rate of interest realized by investors on the four per cent bonds was at its lowest point in the quarter beginning with April, 1889. It was soon after this that the circulation secured by bonds reached nearly its lowest point, and became stationary. The value of bonds as an investment had been

falling since the beginning of 1885, when the process of retirement was attaining momentum. The value began to rise again towards the close of 1889, and reached a figure in the middle of 1890 which practically ended the retirement of bank-note circulation. The premium dropped from nearly 121 to 116.75 during 1891, and the circulation secured by bonds advanced from $125,660,361 at the beginning of the year to $140,084,203 at the beginning of the next year.

Such a sensitiveness to a slight change in the investment value of a bond shows upon what narrow margins the banking transactions of today depend. The "double interest" which was supposed by the demagogues to be piling up such fabulous fortunes for the bankers proved an insufficient attraction to keep their circulation afloat when the bonds fell off a fraction of a cent in paying value. It was only when the demand for currency began to grow that the issue of bank-note circulation again became profitable, and led to the large increase of the past few months. There is an opportunity to make the banking system more responsive to the occasional demands for currency by increasing the proportion which the notes issued bear to the face value of the bonds. This was fixed at ninety per cent in the original act, with a just regard to the discount on bonds, but there is perfect security today in fixing it at one hundred per cent, and affording the banks an opportunity to increase their present volume of circulation by about eleven per cent. It would add but a minute fraction to their profits, but that fraction might turn the scale in favor of increased circulation when the country was most in need of it.

This change of the law has been recommended by at least four successive comptrollers of the currency, and has several times been favorably reported upon by committees of Congress. It is now embodied in a bill under discussion in the Senate, and which seems likely to become a law. The question of thus increasing our monetary circulation through the national banking system becomes of greater importance than

heretofore, if the means of expanding the circulation which exist in the silver act of February 28, 1878, and the later act of July 14, 1890, are brought to an end. The repeal of the Sherman law will leave only two available avenues of increasing the circulation to keep pace with the growing population and volume of business in the country. Those means are the importation of gold, which can be converted into gold certificates upon presentation at the Treasury, and the increase of national bank-note circulation. The latter device may not be adequate for a prolonged future, but it is likely to afford an element of growth in the volume of the circulating medium sufficient to enable Congress to deliberate, for two or three years if need be, upon the substitution of a simple and sound currency system for our present complicated and uncertain conglomeration of gold coin, silver coin, gold certificates, silver certificates, United States notes, Treasury notes, and national bank notes.

Synopsis.]

CURRENCY REFORM IN AUSTRIA-HUNGARY.

By Dr. Julius Mandello,

Budapest University and Ministry of Finance, Hungary.

The currency reform in Austria-Hungary is one of the most interesting problems with regard to the monetary system, because in all currency reforms which are described in the monetary history of our century there is no one to which the currency reform of Austria-Hungary can be compared.

It is very important to note in the first place that currency reform in Austria-Hungary includes two widely different steps of financial evolution. The country has some hundred millions of florins of paper money, state notes, not covered by any metal, and being by law a legal tender. The first part of the currency reform consists in the abolition of this paper money, and in beginning and continuing to pay cash, or metal money, for the state's notes. As a second part of the currency reform, but very closely connected with the first part, is a change of the currency system.

This currency reform is not only very interesting to the political economist and to the man of jurisprudence, on account of the important economical changes which will follow this reform, and on account of the complicated judicial questions which are connected with the problem, but there is also a great field of work for the statistician. The history of money in Austria-Hungary cannot be understood without very complicated statistical tables, and it is quite a new problem to point out the relation between the value of the Austrian-Hungarian currency (so-called) and the price of silver since the year 1879, at which time the coining for private persons in the mints was stopped. The statistical problem consists in the establishing of the supposed purchasing power of the Austrian-Hungarian currency in different times, a problem which needs a large collection of statistics

of prices. I hope to be able to submit to the International Statistical Institute tables built up partly from private material and partly from material collected by the two ministers of finance in Austria and in Hungary, and I believe that it is not necessary to say a great deal about these tables, as I have always believed that statistical tables speak much more strongly to a scientific statistician than many printed pages. The only thing I presume to be necessary for understanding this collection of statistical material is to have a clear idea of the character of the Austrian-Hungarian monetary system as it has been established until recently and of the new feature which is to be established by the currency reform.

The history of the currency in Austria-Hungary is a history of disease, but it is only the last phases of this disease which interest us, and which began twenty-five years ago. Austria adopted at that time the pure silver currency system. It was provided by law that for every pound of pure silver there ought to be coined forty-five florins, and this relation of measure is the basis of the monetary system. For different political and economical reasons the treasury was obliged to issue paper state money without any metal basis, and which was declared to be a legal tender. At the same time it was necesary to change in part the character of the bank notes. Austria-Hungary has only one bank (called the "Austrian-Hungarian" Bank, or formerly the "National Bank") having the privilege to issue notes. This bank lent a good deal of its credit to the state, so that at the time when the state itself issued 312,000,000 florins of state notes it would have been a case of impossibility for the bank to pay silver for the bank notes presented to it. It was therefore provided by law that as long as the state notes were enforced the bank ought not to be obliged to pay back silver for the notes presented to the bank officers, but that silver and state notes could be ultimately used. Resuming this monetary situation, it was a pure paper currency system grown up on a silver basis.

During the period from 1867 to 1878 the Austrian-Hungarian money had always an agio against the silver money, but at the same time the price of silver in the whole world declined, and the difference between the value of a silver florin and a paper one became always less. Ultimately, there was no difference at all, but only for a short time. At this time (1879) the two governments decided that the free coinage of silver ought to be stopped in the mints for private persons, as the constantly declining price of silver gave an excellent chance to these people to make large profits at the expense of the community. In this way did it happen that the free coinage of silver was stopped in 1879, and there was only a limited amount of coinage by the two governments.

Now begins the very interesting problem of the evolution of the value of the Austrian-Hungarian currency quite or nearly independent from the value of silver quoted at the market. Really, the paper florin, and with them the few silver florins that had been in circulation, now became a disagio. In regard to the silver question, Austria-Hungary was in the same situation as is now to be found in the United States, *i. e.*, the circulating paper and silver money had a higher value than the silver for which it circulated or which is contained in it. These different features had, from an economical point of view, borne an influence on the common events in Austria-Hungary. There were to be feared two things: First, that the value of money would constantly increase; and, second, that there would be rapid changes in the value of currency.

These changes having their constant expression in the quotations of the foreign markets, the statistical table of the Austro-Hungarian exchanges quoted in gold countries, or the quotations of gold exchange at the stock exchange of Vienna and Budapest, show perfectly this constant fluctuation in the value of the Austro-Hungarian money. On account of this fluctuation there is, in the first place, a speculative tendency to the whole business, and, in the second

place, a dependence of the countries with which Austria-Hungary has a strong commercial connection, these being all gold-standard countries. Austria-Hungary also being a state with many international debts, contracted in great part in gold, the state itself was constantly obliged to speculate in regard to paying the interest of its bonds. As, on the other hand, the whole economic situation of the two countries was very prosperous for the last twenty years, it was decided to change the state of the monetary system. It was decided to pay off the state paper money, and to issue for this purpose bonds. In the second place, silver not showing more of a constancy of value needed for a standard, international bimetalism, even if theoretically acceptable, being impossible at present for political reasons, Austria-Hungary decided to accept the monometalism and the gold standard, joining in this way its western neighbors and commercial connections. In the tables to be submitted it will be necessary to give a *résumé* upon subjects entitled as follows: —

Monetary statistics at the year 1892.

Description of the different laws establishing the new currency.

Description of the question to be solved concerning the relation between the new gold standard and the old paper standard.

Criticisms of the statistical work done in regard to pointing out the average quotation of this relation.

Description of the state of transition.

Actual results and statistical data down to the present state.

COMPARATIVE STATISTICS OF PRIMARY EDUCATION.

By E. Levasseur,

On Behalf of the Committee of Statistics of Primary Education.

In 1889 the International Statistical Institute, in its session at Paris, appointed a committee to study the methods and results of primary education.

The reporter, M. E. Levasseur, presented to the session at Vienna, in 1891, a report composed of two parts: (1) Ten chapters devoted to the study of primary education in England, Scotland, and Ireland; in Holland, France, German Empire (Prussia, Saxony, Bavaria, Baden), Switzerland, Austria, and Hungary, Sweden, and Norway; (2) Comparative statements upon the pedagogical organization, statistical methods and situation of education in the above-named states.

M. Levasseur presents today on behalf of the same committee a second report, composed on the same plan, in which the following states are described: Spain, Portugal, Roumania, Finland, United States, and the Argentine Republic.

The data upon which this report is based have been prepared and sent to M. Levasseur by the directors themselves of the statistical service, who are nearly all members of the International Statistical Institute. That *résumé*, as regards the European states, is limited to the most characteristic facts.

SPAIN.

	1846.	1885.
Number of public schools	12,337	24,529
" " private "	3,283	5,576
" in 1880, of teachers in public schools	23,783	.....
" " " " private "	9,751	.....
" of pupils in public schools	549,607	1,552,434
" " " " private "	114,004	290,749
Expenses for public primary education	29,149,974 pesetas.	.....

PORTUGAL.

	1885-86.	1888-89.
Number of schools	5,384	5,339
(Of which are official schools)	(3,657)	(3,825)
Number of teachers	3,776	4,069
" " pupils	236,936	237,783
In 1883, expenses for public primary education	564,667 nubréis.	.....

ROUMANIA.

	1872-73.	1891-92.
Number of primary schools	2,401	3,994
" " teachers in the public schools	2,480	3,938 [1]
" " pupils	92,023	238,681

[1] The number of teachers in private schools was 855 in 1872-73; it is not given for 1891-92.

FINLAND. PUBLIC SCHOOLS ONLY.

	1873.	1891.
Number of schools	408	1,134
" " teachers	408	1,385
" " pupils	18,234	51,000
Expenses	.....	2,815,000 marks[1]

[1] All the expenses are not included in this total.

Taking into consideration the great importance of the American people, and the educational system in the United States, the chapter on the United States is much more developed. The numerical data have been taken mostly from the *Annual Report of the Commissioner of Education*. It includes briefly the history of primary education from the act of Massachusetts in 1642 to the present time, and indicates why the establishment of the free-school system and the general improvement and propagation of primary education are the one essential condition of American democracy.

Then the reporter investigated (1) The administrative organization of education in some states, particularly in Massachusetts, Rhode Island, and Illinois; (2) The courses of studies and number of hours attributed to each course, accord-

ing to the chart exhibit in the World's Columbian Exposition, by W. T. Harris; and, (3) The works of those collectors of public statistics, which are condensed in the most important *Annual Report of the Commissioner of Education.*

That part of the chapter devoted to the results of the statistical work states for each state or territory, for several years, the number of schools, teachers, pupils, etc., and for the United States the general yearly results since 1870. It would be sufficient to give in the present outline a summary of the accomplished progress, and extract some statistics relating to three years, 1870, 1880, and 1890.

Common Schools.	1870.	1880.	1890.
Number of school houses	116,312	178,222	226,839
Value of school property	$130,383,008	$209,571,718	$342,876,494
Number of teachers, male	77,520	122,795	125,002
" " " female	129,932	163,798	283,333
" " " total	230,225	286,593	563,935
Expenses for salaries	$37,832,706	$55,942,972	$91,683,338
Total expenditure	$63,396,066	$78,094,087	$140,277,484
Number of enrolled pupils	6,871,523	9,867,505	12,697,196
Average attendance	4,077,347	6,145,932	8,144,938
Attendance per 100 enrolled	59.3	62.3	64.1
Average number of days of class in school	132.2	130.3	134.3
Number of pupils in private schools	.....	.....	1,611,200

In the United States, according to their population, the proportion of enrolled pupils is very high, 22 per 100 out of the total population are enrolled in public or private schools. Nevertheless, because the number of the class days is limited (134), and the attendance, while greater than formerly, is only 64 per 100 in 1890, the result is that every pupil is, by average, attending school only 87½ days. The proportion is much better in towns (190 class days, and 70 attending out of every 100 enrolled) than in the country (115 class days, and 62 attending).

In the second part of his report, M. Levasseur says that, as in most other matters of facts, so in educational statistics, an international comparison is very difficult to establish, and

that this kind of comparison cannot be absolutely correct. The institutions are not the same everywhere, and the same names (or about the same by translation) do not cover the same things; so the common schools in America are not exactly corresponding to *ecoles primaires publiques* in France, and much less to "inspected schools" in England. The enrollment of pupils and the statement of attendance are not established upon the same system; the name *la chef* or *maitre* does not signify the same degree of science or the same professional attainments in all countries.

Of course, the reporter concludes that the international statistics of primary education is an interesting subject of inquiry, very useful, but practical only for pedagogues who know sufficiently the diversity of institutions; and that the results must be used only with caution. If one extract statistics from two statistical volumes published by two different states, and compare them without stating beforehand that they are really of the same species, he would be exposed to gross mistakes and false judgments.

As the International Statistical Institute intends principally to propose uniform rules in matters of public statistics and promote the statistical publications, the reporter ends his report enumerating the necessary data for the statistics of primary education, and inviting every civilized state to publish, at least once in five years, an official record of statistics on this matter. That is a minimum requested by M. Levasseur; but many states have not yet given it. The United States give much more; so, instead of looking to others as a model, they may be rather cited as an example.

Two comparative tables, extracted from the second part of the report, are as follows:—

Year.	States.	Public Schools.	Private Schools.	Total.
1890	England and Wales	19,498	.....	.....
1890	Scotland	3,076	.....	.....
1889	Ireland	8,251	.....	.....
1889	Holland	2,952	1,263	4,215
1890	Belgium	5,673	.....	.....
1890	France	67,359	14,498	81,857
1886	Prussia	34,016	1,209	35,225
1889	Saxony	2,205	77	2,282
1890	Baden	1,580	30	1,610
1890	Bavaria	7,141	57	7,198
1890	Austria	17,619	979	18,098
1880	Hungary	17,619	979	16,702
1889	Italy	44,664	7,975	52,639
1889	Sweden	10,516	.....	.....
1888	Norway	6,282	.....	.....
1885	Spain	24,529	5,576	30,105
1889	Portugal	.....	.....	5,339
1892	Roumania	.....	.....	3,994
1891	Finland	.....	.....	1,891
1890	United States	224,839	.....	.....

Year.	States.	Number of Pupils.	Observations.
1890	England and Wales	4,341,364	Only inspected schools.
1890	Scotland	664,466	Only inspected schools.
1889	Ireland	507,865	Only inspected schools.
1889	Holland	652,978	
1890	Belgium	616,091	Only public schools.
1890	France	5,601,567	
1886	Prussia	5,082,252	
1889	Saxony	583,242	
1890	Bavaria	831,829	
1890	Switzerland	476,101	Only public schools.
1890	Austria	2,872,929	
1889	Hungary	2,015,612	
1889	Italy	2,241,220	
1889	Sweden	668,112	
1888	Norway	295,239	Public schools only.
1885	Spain	1,843,183	
1889	Portugal	237,783	
1892	Roumania	238,681	
1891	Finland	51,000	Public schools only.
1890	United States	12,697,196	

The conclusions are the same as those of the previous report. The Committee recommended to every state to publish a statistical report on education at least every fifth year,

and to define exactly in this report the meaning of the words school, class, teacher, pupil; to include in those statistics (1) *Appropriations for the public schools* (from state and other sources); (2) *Number of primary schools* (public and, if it is possible, private); (3) *Number of teachers; number of pupils;* (4) *Number of enrolled scholars who can read*, for the countries in which this information exists. These statistics are to be regulated according to the definitions adopted at the Vienna session.

RESULTS OF RECENT INVESTIGATIONS ON PRICES IN THE UNITED STATES.

By Prof. F. W. Taussig,

Harvard University.

In 1891 the Finance Committee of the United States Senate was instructed to gather information as to the course of prices and wages in the United States, the object in view being to secure authentic facts bearing on the effects of tariff legislation. In 1892 the first report of the Committee was presented, giving the results of an investigation as to retail prices immediately before and immediately after the passage of the Tariff Act of 1890. The second report of the Committee, issued during the present year, treats of the course of wholesale prices, of wages, and transportation rates, for the half century from 1840 to 1891. It is with the results of this second investigation that the present paper is concerned.

Virtually, both these reports may be regarded as publications of the Department of Labor. The Senate Committee wisely put the task of collecting the desired facts and figures in the charge of that Department, and the skill and judgment of Commissioner Wright have yielded results whose importance and interest to the economist can hardly be overstated. Not only that, but the task of analyzing, digesting, and presenting the salient results was put into the trained hands of Prof. R. P. Falkner, whose introductory synopsis cannot be too highly praised. The whole report fills four large volumes; of these the first contains Prof. Falkner's synopsis. Here economists will find much the greater part of the results on the movement of prices presented in so clear and so skillful a manner as to dispense largely with the need of consulting the detailed figures which occupy the later volumes.

The investigation is probably the most complete and thorough that has ever been made in regard to the develop-

ment of prices. The wholesale prices of 223 articles were obtained from 1860 to 1891, and the prices of 90 of these articles was secured for the whole period from 1840 to 1891. There are returns of wages for 443 distinct series of laborers, covering 21 occupations, running from 1860 to 1891; while for 61 of these series returns were obtained for the whole period from 1840 to 1891. There are elaborate data as to the development of transportation rates by rail and water. There is hardly a phase of the economic history of the United States on which the economist will not find valuable material in this great collection. In the present paper I shall discuss only the results in regard to the development of prices, and even as to these can touch on some of the more interesting topics only.

The first, and perhaps the most interesting point of all, is the method by which a general expression of the course of prices, from year to year, was obtained. The familiar index-number method was followed by Prof. Falkner, but followed with exceptional skill and with some variations from the customary applications of it. In preparing the index numbers the year 1860 was selected as a base, all prices in that year being indicated by the number 100. The selection of this year was due partly to the peculiar industrial conditions of the United States, and partly to the circumstance that many of the statistics could be carried back farther than 1860. It was a normal year, marked by prices neither much higher nor much lower than those of the years immediately before and after; it preceded the Civil War, giving a convenient standard for measuring the effects of the paper money issues of the War; it was the first year for which the figures were secured for the whole list of 223 articles. The prices for this year being, then, selected for the base, the prices for other years were indicated by their index numbers in relation to this standard. In averaging the index numbers, and so securing the general index number for earlier and later years, two methods were followed: the method of simple arithmetical

average, and that of the average weighted or modified according to the importance of the articles. The mode in which the weighted average was used, and the extent to which the results so secured differ from those of the simple arithmetical average, are among the most important features of the investigation.

The weighted average was applied by assigning importance to different commodities in proportion to their importance in the budget of expenditures of families of moderate means. In budgets gathered by the Department of Labor the items of expenditure of workingmen's families for food, clothing, and other things were ascertained, and weight was given to the different commodities, in making up the general average, according to their importance in these budgets. This method of weighting differs from that employed by Mr. Palgrave and by some German economists, who assign importance to different commodities according to the part which they bear in the total expenditure of the whole community. The results of the two methods must be the same if the share which a particular commodity had in the expenditure of the family type selected were the same as its proportion in the total expenditure of the community. But if the family type selected were that of the workingman, as in the Committee's report, it is probable that the results of the two methods would differ. Which is the better must depend upon the objects sought to be obtained. If a social object is had in view — if it is desired to learn whether the purchasing power of a workman's income has risen or fallen — the budget method is clearly the better. If the monetary problem alone is had in view — if it is desired to ascertain whether a given sum of money will buy more or less commodities at large — the method of importance according to general expenditure is the better.

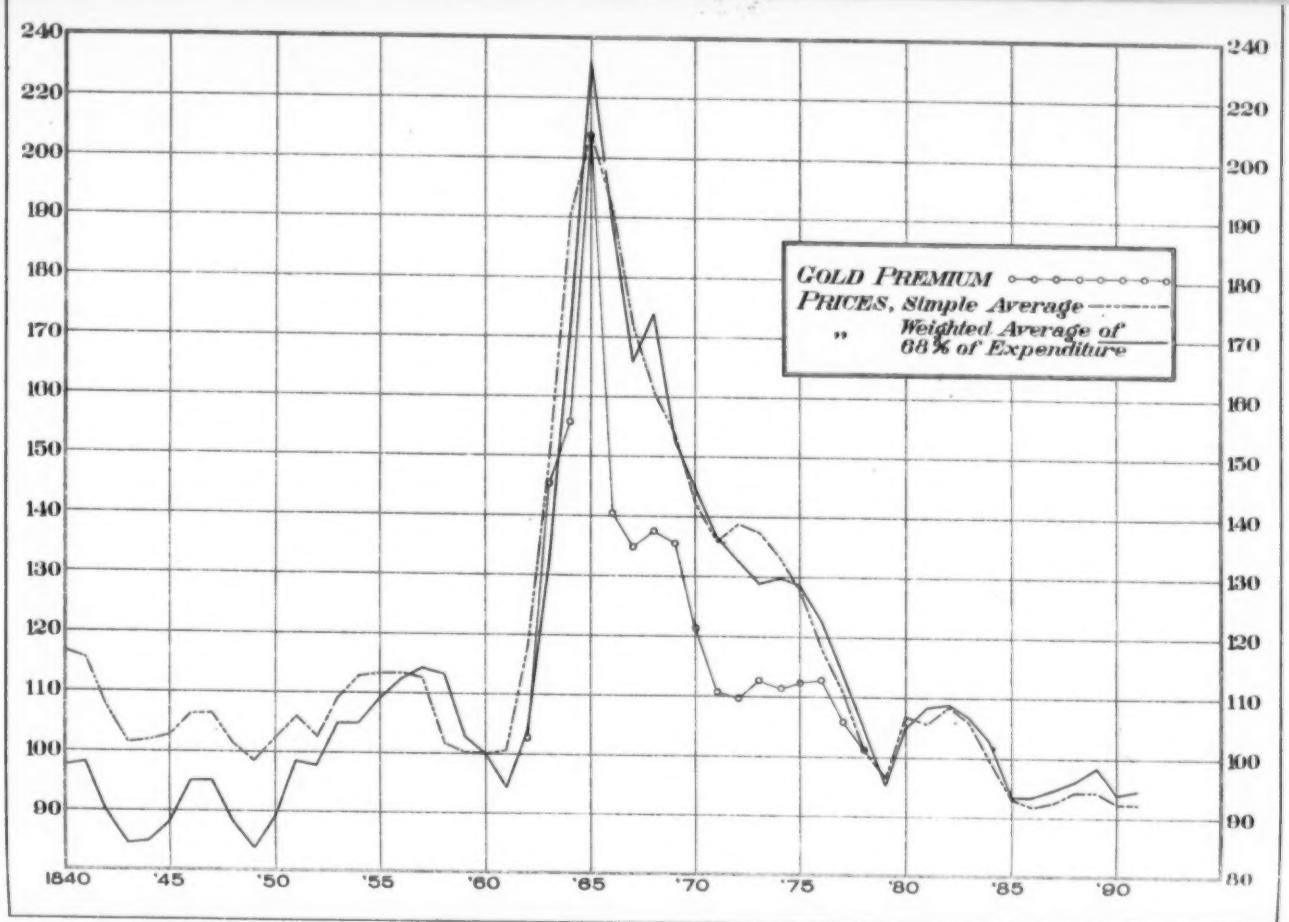
Another question of much interest in the technique of statistics is that of the feasibility of carrying out the budget method. There are obviously great difficulties in ascertaining what proportion of the expenditure of the workman's

family goes to many of the articles whose prices are quoted. Prof. Falkner has met these difficulties with great skill, and, although he has been compelled to resort to suppositions and combinations of a somewhat artificial character, he has, nevertheless, surmounted the practical difficulties of the budget method with a high degree of success.

Turning now to the results secured by these two methods we find a surprising agreement. The main results are shown on Chart I, where the two lines indicate, one, the general range of prices as ascertained by the simple arithmetical average; the other, the general range of prices as ascertained by the weighted average. They run together with remarkable closeness. During the years from 1840 to 1860 they diverge somewhat, the weighted average being lower than the simple average. The divergence may arise because the prices of a smaller number of articles were ascertained in this earlier period, and may be due to the fact that food, which of course affects the weighted average more than the arithmetical average, was then lower. But in the thirty years from 1860 to 1891 the results are in remarkably close correspondence. The extraordinary rise in prices due to the paper issues of the Civil War comes out with dramatic force, while the fall in prices from the close of the war to the resumption of specie payments in 1879 is equally patent. After 1879 there is first a slight rise, during the period of activity which set in with the year 1880, then a slow but fairly steady tendency to a fall. For further comparison with the United States prices the course of prices in Europe, according to the index number prepared by the late Prof. Soetbeer, and in the United States according to the present investigation, are shown on the second chart. The Soetbeer figures, it will be remembered, are computed from the arithmetical average of the prices of 114 articles, and may be fairly compared with the average similarly computed for United States prices.

Another problem on which the report throws light, though not so much light as might be desired, is the relation of the

CHART I.

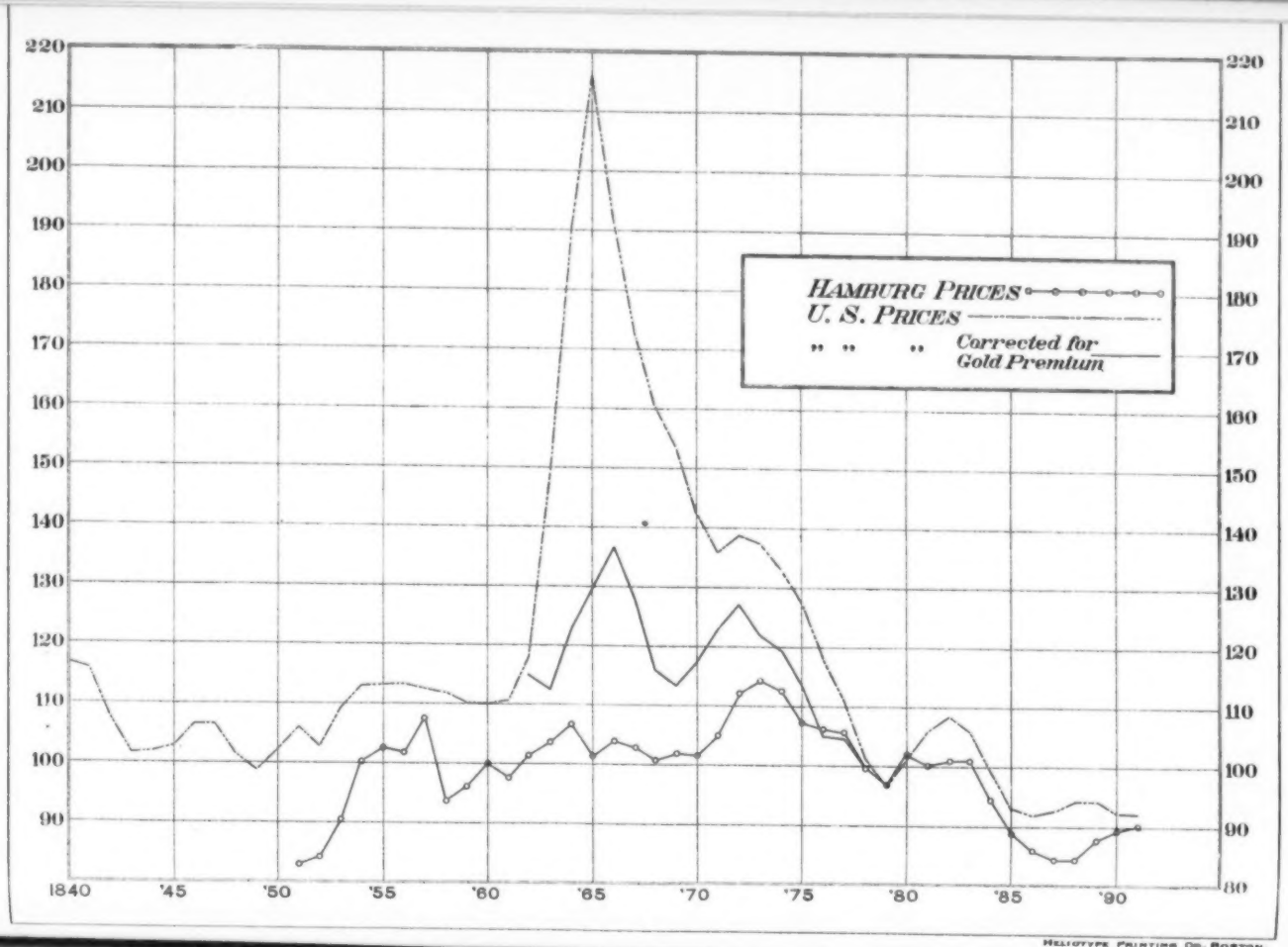


HELIOTYPE PRINTING CO., BOSTON

1840	45	33	33	11

Heliotype Printing Co. Boston.

CHART II.



HELIOTYPE PRINTING CO. BOSTON.

premium on specie to the general range of prices during the period of suspended payments. While the premium on specie may be taken for some purposes as a measure of the depreciation of inconvertible paper, the real depreciation is measured by the general rise in prices over what they would have been under a specie standard. With that general rise the premium on specie may or may not correspond. For the purpose of illustrating the result on this point the course of the specie premium has been indicated on Chart I, and may be compared with the movement of prices as ascertained by the simple arithmetical average. Unfortunately, the comparison is not sufficiently complete. The prices ascertained and averaged are the January prices of each year; to make possible a direct comparison the line indicating the course of the specie premium had therefore to be derived from the January quotations of gold for each year. But the premium on gold fluctuated so violently from 1862 to 1866 that these January quotations give us by no means an accurate picture of the course of the gold premium; and it is probable that the January quotations of prices during this period are similarly unsatisfactory as indicating the general movement of prices during these years of confusion. The comparison of the two therefore cannot be considered very valuable for these earlier years. After 1866, or 1867, the fluctuations both in prices and in gold premium were less abrupt. The January quotations of the two are more comparable and more trustworthy as indicating the situation for the year, and the lines of the Chart are more instructive. It will be seen that the gold premium sinks more rapidly than does the course of general prices. In other words, the real depreciation of the currency was then greater than the gold premium indicated.

Synopsis.]

GEOGRAPHICAL CONCENTRATION: AN HISTORIC FEATURE OF AMERICAN AGRICULTURE.

By John Hyde,

Expert Special Agent in Charge of the Statistics of Agriculture, Eleventh U. S. Census.

The agriculture of a country, the capabilities of which are so enormous that its annual production of a single cereal is measured by billions of bushels, and which in the ten years ending June 30, 1890, sold $5,639,203,272 worth of its agricultural products to other nations after supplying the requirements of its own large population; a country whose climatic range extends from the sub-arctic to the sub-tropic, modified by the greatest lake system and two of the greatest mountain ranges in the world, and with a mean annual rainfall varying from 1.85 inches in its most arid region to 105.25 inches in its region of greatest precipitation; a country occupied by so composite a people that in three of the greatest agricultural states in the Union, including the state that stands first in the production of wheat, the foreign-born element in the agricultural population out-numbers the native, while in another great agricultural state there are 136 negroes to every 100 whites,— the agriculture of such a country necessarily possesses many features of great interest. Among them is that tendency to geographical concentration which has always characterized the cultivation of many of the principal products of the soil. Reference is not made to those limitations of the area of production which are imposed by the conditions of climate, as in the case of the sub-tropical products of the states bordering on the Gulf of Mexico, but only to products that have a wide climatic range, such as the principal cereals, tobacco, flax, hemp, hops, etc., the cultivation of which has always been distinguished by a more or less remarkable geographical concentration.

Maize is cultivated to a greater or less extent from the most easterly county in the State of Maine to the most westerly in the State of Washington, and from the valley of the Red River of the North to the confines of the Everglades of Florida, and yet at no agricultural census ever taken has there been less than 38.57 per cent of the total crop produced in what have been for the time being the four leading maize-producing states, while the proportion has been as high as 52.36 per cent, and was 50.80 per cent at the last census. Of the total wheat crop of 1839, 61.52 per cent was produced in four states containing only 5.84 per cent of the entire land surface of the country. Fifty years later those states produced only 15.66 per cent of the total, and four others, containing 11.01 per cent of the total land surface, produced 35.85 per cent of the total crop. Of the total production of oats in 1839 56.20 per cent was produced in four states, containing 5.84 per cent of the entire land surface of the country. In 1889 48.82 per cent was grown in four other states, containing 8.25 per cent of the total land surface. Although the enormous increase in the cultivation of oats between 1879 and 1889 was more generally distributed over the entire country than the increase in any other important product, the percentage of the total crop of the country grown in the four states of largest production was even greater in 1889 than in 1879. The concentration of the production of barley has been still more remarkable. In 1839 the State of New York produced 60.56 per cent of the total crop of the country. Fifty years later the combined crops of the three states leading in the production of this grain constituted 58.95 per cent of the total, those of two other states increasing the proportion to 81.06 per cent. Barley has a very wide climatic range, its limit of successful cultivation extending farther north than that of any other cereal, while it can also be profitably grown in sub-tropical regions. Nevertheless, its production in the United States is practically confined to a few states, and always falls short of the demand. In 1839 over

one-half of the rye crop of the country was contributed by two states, and in 1889 the three leading rye-producing states of that time produced 38.92 per cent of the total crop. At six successive decennial censuses over 60 per cent of the total production of buckwheat has been raised in New York and Pennsylvania. In 1839 58.76 per cent of the total tobacco crop was raised in two states. In 1889 the same states produced 55.38 per cent, although this product has an exceedingly wide range of profitable cultivation. In 1849 the four states producing the largest quantity of flaxseed raised 66.68 per cent of the entire crop. In 1889 four other states, then leading, produced 80.06 per cent of the total. Hemp flourishes from the White Sea to the Mediterranean, and over extensive regions in three other continents, yet its cultivation in the United States is almost entirely confined to ten counties in Kentucky, notwithstanding that the production is sufficient for the requirements of the country. In 1849 72.53 per cent, and in 1889 51.22 per cent, of the total hop crop of the country was produced in New York.

The tendency henceforward, however, will almost certainly be toward decentralization. The multiplied wants of a rapidly increasing population, together with a general recognition of the advantages of mixed farming, have already greatly diversified the agriculture even of the newer regions west of the Mississippi River. Minnesota, which in 1889 led the entire country in the production of wheat, had its total cereal-producing area of 6,297,044 acres more evenly distributed among the different grains than was that of any other state in the Union. It is only a few years since, in the great wheat belt of North Dakota, it was impossible to procure eggs, butter, cheese, or fruit that had not been brought hundreds of miles from some leading produce market, or some agricultural district that was not so completely given up to a single branch of the industry. Now all this is changed. The practical exhaustion of the public domain, the necessity — soon to become apparent — of a more considerate treat-

ment of the soil on the part of the farmers of the western states, the establishment of agricultural experiment stations, and the extension of manufactures will contribute still further toward the diversification of agriculture. There will, however, in all probability, continue to be certain localities given up almost entirely to the cultivation of particular products without possessing any especial advantages for so doing, either in the way of soil, climate, or facilities of transportation.

Synopsis.]

THE COURSE OF WAGES IN THE UNITED STATES SINCE 1840.

By Carroll D. Wright,

United States Commissioner of Labor.

The data for this paper are taken from a report of the Committee on Finance of the United States Senate, but they were largely collected by the Department of Labor, and therefore under my personal supervision. The statistics of wages include the rates of wages paid in nearly 100 distinct establishments, covering 22 industries, for the period from 1840 to 1891, inclusive. Only the general rates of wages as shown by the report of the committee referred to form the subject of the paper, but these statistics cover each year during the whole course of the period, so far as establishments could be found able to furnish pay-rolls for the whole period, or for any major part of it, and all the quotations given are taken directly from pay-rolls themselves. Of course, great difficulty arose in finding establishments which could furnish consecutive pay-rolls for all the years of the period comprehended, yet in a sufficiently large number of cases conditions favorable to an accurate report were found to exist. There is, therefore, for the first time in this country, a continuous record of the rates of wages paid in the principal industries of the country for a long period of years. An exception to this statement is made by reference to the valuable work published in the Tenth Census, compiled by Mr. Joseph D. Weeks.

Only nominal wages therefore are dealt with in the paper. To treat of the real or economic wages would have taken me too far afield.

The method adopted for ascertaining the general course of wages is that of selecting a particular year as a basis for cal-

culation, and the year selected is 1860, as that represents more nearly than any other in the whole period a normal year. All quotations in all the industries reviewed are, for 1860, put at 100. Fluctuations each side of 1860 are therefore represented by fractional parts of 100, as, for instance, if a man received $1 per day in 1860, which has been represented by 100, and in 1885 he received $1.75 per day, then the entry for 1885 would be 175; and if in 1840 he received 87 cents per day, the entry for comparison with 1860 would be, for 1840, 87. This simple method was adopted by the Senate Committee on Finance, and all the calculations in their report made in accordance therewith. The same method was adopted in making comparisons as to prices of commodities, the committee having in mind always the relation which each principal article bore to the total consumption.

The various individual statements relative to industries and localities are taken up, showing the course of wages since 1840. These need not be reported in this abstract, but as a general conclusion of the paper, so far as wages are concerned, the following table represents, on the basis already described, the results for all the industries: —

RATES OF WAGES FOR 52 YEARS—RELATIVE WAGES, BY INDUSTRIES.

GENERAL AVERAGE OF WAGES.

Year.	Agricultural Implements.	Ale, Beer, and Porter.	Books and News-Papers.	Building Trades.	Carriages and Wagons.	City Public Works.	Cotton Goods.	Dry Goods.	Ginghams.	Groceries.	Illuminating Gas.
1840	.....	.....	.....	85.0	100.0	.....	86.0	.....	.....	.....	92.7
1841	.....	.....	.....	85.0	100.0	.....	80.6	.....	.....	.....	94.3
1842	.....	.....	68.6	86.2	100.0	.....	87.5	.....	.....	.....	91.3
1843	.....	78.2	72.3	84.7	100.0	.....	87.6	.....	.....	.....	93.1
1844	.....	68.8	73.8	85.0	100.0	.....	85.7	.....	.....	.....	93.4
1845	.....	.....	74.8	86.6	100.0	.....	86.6	.....	.....	.....	96.4
1846	.....	.....	77.3	88.9	100.0	.....	90.8	.....	.....	.....	93.8
1847	.....	.....	78.2	92.6	100.0	.....	91.9	.....	.....	.....	95.2
1848	.....	.....	81.6	92.0	100.0	.....	93.4	.....	.....	.....	96.6
1849	.....	.....	85.3	89.6	100.0	.....	94.5	.....	94.2	.....	93.7
1850	.....	.....	89.1	86.2	100.0	.....	93.9	102.7	98.1	.....	94.6
1851	.....	.....	80.3	87.9	100.0	.....	87.7	102.7	94.5	.....	94.6
1852	.....	.....	82.1	88.7	100.0	.....	87.9	102.7	94.5	.....	92.9
1853	.....	.....	84.7	90.6	100.0	.....	90.4	102.7	94.6	.....	95.3
1854	.....	98.8	86.8	93.4	100.0	102.1	94.5	102.7	97.0	.....	98.1
1855	.....	84.5	88.9	95.7	100.0	103.1	98.7	102.7	99.0	100.0	100.5
1856	.....	90.6	86.1	96.5	100.0	100.2	101.2	102.7	101.1	100.0	99.4
1857	98.0	93.0	92.0	98.7	100.0	102.1	102.0	102.7	101.9	100.0	99.5
1858	103.1	96.0	98.0	95.8	100.0	97.5	96.9	102.7	101.9	100.0	99.0
1859	94.9	97.2	97.2	100.8	100.0	102.5	98.6	100.0	102.9	100.0	100.2
1860	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1861	102.1	105.3	96.6	100.4	100.0	98.4	98.9	.....	101.2	100.0	100.9
1862	99.8	115.4	98.9	106.3	169.9	97.8	99.2	100.0	102.8	145.2	101.6
1863	105.5	116.1	103.5	119.7	169.9	108.7	106.0	126.9	104.4	159.5	113.7
1864	111.7	127.8	114.0	143.7	169.9	135.8	122.3	126.9	106.7	159.5	141.6
1865	141.9	134.0	135.0	161.1	169.9	150.8	134.7	135.7	123.2	159.5	164.0
1866	156.8	157.7	139.2	170.0	169.9	154.4	153.2	135.7	146.0	159.5	171.0
1867	155.6	158.9	145.4	185.1	169.9	165.0	160.4	135.7	151.5	159.5	172.8
1868	152.3	163.9	156.0	185.5	169.9	169.9	160.9	135.7	153.7	159.5	182.9
1869	151.5	168.3	157.7	189.2	179.9	171.4	161.8	134.3	153.1	159.5	188.0
1870	152.6	168.5	156.1	185.5	179.9	172.9	160.6	134.3	154.2	147.5	186.1
1871	152.1	168.1	159.8	182.7	179.9	175.3	165.3	134.3	161.9	147.5	188.9
1872	154.0	169.1	159.4	185.3	179.9	182.4	169.0	132.8	164.2	147.5	189.4
1873	152.4	172.4	164.0	179.4	179.9	177.5	167.2	132.8	165.5	147.5	207.0
1874	157.1	178.2	159.3	178.1	179.9	179.5	155.8	132.8	163.3	147.5	201.7
1875	158.5	174.6	159.2	169.2	179.9	178.8	150.3	132.8	158.2	157.2	193.7
1876	141.3	159.4	155.9	158.6	179.9	168.0	142.1	132.8	156.9	157.2	190.3
1877	129.4	159.4	150.7	146.3	179.9	155.1	135.5	132.8	149.8	157.2	180.1
1878	130.6	179.2	145.6	140.7	179.9	141.9	135.3	134.0	148.5	159.5	174.2
1879	128.1	171.7	141.9	137.9	179.9	138.7	136.2	134.0	147.3	159.5	159.4
1880	124.9	176.2	140.7	142.7	202.4	141.5	139.9	134.0	143.8	159.5	154.3
1881	124.6	182.4	141.3	160.1	202.4	145.5	144.8	134.0	146.0	159.5	158.1
1882	133.4	183.7	139.0	165.1	202.4	151.9	146.8	134.0	147.5	159.5	163.2
1883	139.8	158.5	146.6	166.0	202.4	158.4	146.5	.....	148.9	159.5	168.3
1884	137.7	177.6	142.6	168.5	202.4	162.0	146.6	132.8	144.1	159.5	166.2
1885	132.0	179.9	145.2	169.9	202.4	162.8	143.5	132.8	137.4	194.7	166.4
1886	140.0	180.2	143.5	170.3	202.4	163.5	147.0	135.7	137.0	194.7	164.5
1887	140.3	202.1	144.0	170.1	202.4	163.8	150.6	135.7	143.3	194.7	163.8
1888	139.0	225.2	146.1	170.9	202.4	166.0	153.7	135.7	145.2	194.7	166.5
1889	137.8	224.7	148.7	170.1	202.4	164.8	157.0	162.6	146.5	194.7	166.8
1890	139.0	224.5	147.6	172.7	202.4	164.8	159.7	185.3	152.4	194.7	166.9
1891	137.9	224.7	148.6	172.5	202.4	164.6	165.1	183.6	152.7	194.7	167.7

RATES OF WAGES FOR 52 YEARS—RELATIVE WAGES, BY INDUSTRIES.—*Concluded.*

GENERAL AVERAGE OF WAGES.

Year.	Leather.	Lumber.	Metals and Metallic Goods.	Paper.	Railroads.	Sidewalks.	Spice.	Stone.	White Lead.	Woollen Goods.	All Industries.
1840	.....	59.1	84.6	.....	89.5	.....	.....	80.4	90.7	.....	87.7
1841	.....	56.3	78.9	.....	90.1	.....	.....	87.4	.....	.....	88.0
1842	.....	61.5	94.2	.....	91.2	87.5	.....	79.2	73.8	.....	87.1
1843	.....	70.7	85.1	.....	90.6	87.5	.....	71.8	73.8	.....	86.6
1844	.....	76.0	88.5	.....	89.0	87.5	.....	76.5	73.8	.....	86.5
1845	.....	89.9	83.3	.....	89.6	87.5	.....	80.2	89.5	.....	86.8
1846	.....	92.8	85 7	.....	89.9	87.5	.....	97.8	91.8	.....	89.3
1847	.....	93.8	89.2	.....	92.0	87.5	.....	85.9	89.3	.....	90.8
1848	.....	100.7	89.4	.....	91.8	87.5	.....	82.9	89.3	.....	91.4
1849	.....	97.4	91.5	.....	90.6	87.5	.....	79.2	83.9	.....	92.5
1850	.....	91.8	88.8	.....	92.5	100.0	.....	93.6	88.6	94.0	92.7
1851	.....	91.3	88.5	.....	91.5	100.0	.....	93.8	93.7	94.1	90.4
1852	.....	90.7	89.9	.....	90.0	100.0	.....	96.1	94.2	94.3	90.8
1853	.....	95.3	89.9	.....	91.2	100.0	.....	99.7	93.9	94.9	91.8
1854	.....	99.0	95.8	.....	96.8	100.0	.....	103.7	100.9	95.2	95.8
1855	.....	100.0	98.6	.....	97.5	100.0	.....	98.8	94.5	95.4	98.0
1856	88.9	96.3	100.1	.....	96 9	100.0	.....	103.1	97.6	96.9	99.2
1857	84.4	90.8	101.7	.....	96.7	100.0	.....	103.3	96.6	97.4	99.9
1858	93.2	95.2	100.3	.....	97.0	100.0	.....	101.9	98.8	98.5	98.5
1859	102.6	95 5	98.4	97.6	98.6	100.0	.....	100.9	98.3	91.7	99.1
1860	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1861	110.6	103.6	102.2	100.0	103.3	100.0	100.4	90.7	101.4	103.1	100.8
1862	123.4	107.2	102 8	89.5	101.4	100.0	114.0	91.5	104.8	103.6	102.9
1863	158.4	131.8	106.5	107.2	103.0	112.6	98.5	109.5	109.9	111.7	110.5
1864	153.7	144.6	121.3	108.9	111.7	137.5	106.6	135.7	120.6	120.7	125.6
1865	160.4	153.2	144.9	143.6	133.0	175.0	134.9	146.8	130.3	137.3	143.1
1866	158.1	154.2	148.0	153.9	142.1	187.5	145.9	152.5	131.9	146.1	152.4
1867	151.7	157.1	151.2	161.3	150.7	.....	125.5	159.3	135.2	150.5	157.6
1868	150.7	163.7	153.6	171.4	154.2	.....	129.3	163.8	134.9	144.0	159.2
1869	152.1	165.6	156.3	171.9	157.2	212.5	118.6	169.8	154.5	149.1	162.0
1870	151.6	169.0	157.1	171.1	164.8	212.5	143.9	168.8	119.0	154.5	162.2
1871	153.4	168.1	155.6	173.9	164.4	200.0	122.2	169.9	136.1	155.1	163.6
1872	153.3	172.6	157.7	176.5	164.1	200.0	157.2	173.0	128.9	156.1	166.0
1873	154 9	177.7	160.2	190.1	165.3	200.0	149.2	171.3	140.0	158.2	167.1
1874	153.0	179.5	157.2	181.8	154.5	181.3	143.5	166.7	144.8	148.1	161.5
1875	141.9	171.8	154.2	191.9	157.4	162.5	156.2	161.3	144.8	154.7	158.4
1876	136.4	173.0	149.1	207.1	147.4	150.0	161.1	153.8	136.4	151.8	152.5
1877	136.8	176.8	143.8	167.6	141.9	150.0	160.9	138.9	133.0	142.1	144.9
1878	139 1	177.9	140.6	145.0	136.3	150.0	162.7	137.4	113.0	144.0	142.5
1879	128.9	175.4	134 6	165.3	137.9	150.0	157.1	129.6	119.0	145.0	139.9
1880	131.5	173.3	134.3	158 5	143.8	150.0	151 6	128.7	117.4	151.6	141.5
1881	130.8	176.8	139.0	168.1	148.9	150.0	153.0	136.1	119.7	153.8	146.5
1882	131.6	175.3	144.0	170.2	146.0	181.3	144.2	149.5	124.4	155.7	149.9
1883	133.7	175.4	147.2	181.4	149.4	181.3	155.2	147.4	135.2	163.6	152.7
1884	134.3	169.9	147.0	178.2	147.2	181.3	158.8	150.1	121.1	166.7	152.7
1885	128.2	170.3	143.0	178.8	155.1	181.3	158.2	150.4	129.3	163.1	150.7
1886	132.0	169.6	139.6	181.5	146.5	181.3	156.0	152.5	135.4	165.3	150.9
1887	134.4	170.9	143.3	181.8	145.6	181.3	162.4	153.1	141.1	167.9	153.7
1888	134.9	170.6	144.6	179.1	149.1	181.3	161.0	156.8	140.6	165.6	155.4
1889	131.5	175.1	146.2	182.7	148.3	181.3	162.4	156.9	140.3	165.0	156.7
1890	132.4	176.7	148.0	175.2	147.0	181.3	164.0	161.9	140.8	168.0	158.9
1891	137.6	177.9	148.6	182.3	146.4	187.5	164.2	165.2	140.6	167.8	160.7

To show the relation of wages to prices through the same period, the following table, based on various methods of computation, is introduced for the prices of articles: —

RELATIVE PRICES IN EACH YEAR, 1840-1891, FOR ALL ARTICLES GROUPED BY DIFFERENT METHODS.

Year.	All articles simply averaged.	All articles averaged according to importance, certain expenditures being considered uniform.	All articles averaged according to importance, comprising 68.60 per cent of total expenditure.	Year.	All articles simply averaged.	All articles averaged according to importance, certain expenditures being considered uniform.	All articles averaged according to importance, comprising 68.60 per cent of total expenditure.
1840	116.8	98.5	97.7	1866	191.0	160.2	187.7
1841	115.8	98.7	98.1	1867	172.2	145.2	165.8
1842	107.8	93.2	90.1	1868	160.5	150.7	173.9
1843	101.5	89.3	84.3	1869	153.5	135.9	152.3
1844	101.9	89.8	85.0	1870	142.3	130.4	144.4
1845	102.8	92.1	88.2	1871	136.0	124.8	136.1
1846	106.4	96.7	95.2	1872	138.8	122.2	132.4
1847	106.5	96.7	95.2	1873	137.5	119.9	129.0
1848	101.4	92.0	88.3	1874	133.0	120.5	129.9
1849	98.7	88.9	83.5	1875	127.6	119.8	128.9
1850	102.3	92.6	89.2	1876	118.2	115.5	122.6
1851	105.9	99.1	98.6	1877	110.9	109.4	113.6
1852	102.7	98.5	97.9	1878	101.3	103.1	104.6
1853	109.1	103.4	105.0	1879	96.6	96.6	95.0
1854	112.9	103.4	105.0	1880	106.9	103.4	104.9
1855	113.1	106.3	109.2	1881	105.7	105.8	108.4
1856	113.2	108.5	112.3	1882	108.5	106.3	109.1
1857	112.5	109.6	114.0	1883	106.0	104.5	106.6
1858	101.8	109.1	113.2	1884	99.4	101.8	102.6
1859	100.2	102.0	102.9	1885	93.0	95.4	93.3
1860	100.0	100.0	100.0	1886	91.9	95.5	93.4
1861	100.6	95.9	94.1	1887	92.6	96.2	94.5
1862	117.8	102.8	104.1	1888	94.2	97.4	96.2
1863	148.6	122.1	132.2	1889	94.2	99.0	98.5
1864	190.5	149.4	172.1	1890	92.3	95.7	93.7
1865	216.8	190.7	232.2	1891	92.2	96.2	94.4

By the foregoing table it will be seen that, under whatever method, prices fell on the average about 5 per cent from 1860. As wages had increased to a very large percentage during the same period the relative purchasing power of wages, as indicated by the rates paid, becomes clearly apparent.

SOME RECENT RESULTS IN RAILWAY STATISTICS IN THE UNITED STATES.

By Henry C. Adams, Ph.D.

Statistician Interstate Commerce Commission.

The year 1887 marks a new period in the development of railway statistics in the United States. Previous to this time all official statistics, except those of the Census Office, were collected and compiled under the authority of the Railway Commissioners of the various states. As might have been expected, the requirements of the several states were not harmonious, nor was it possible for any state to carry its line of statistics very far.

Under such circumstances the first effort of the Division of Statistics, created by the Interstate Commerce Commission in the fall of 1887, was to establish uniformity in the nature and scope of questions asked of railways, and it is one of the most promising features of railway statistics in this country that by far the larger number of state railway commissions have adopted the form for annual report of carriers, drawn up by the Interstate Commerce Commission. Many other steps have been taken toward the establishment of uniformity, the most fruitful being those which brought the Statistical Division in direct contact with the auditors of the various railways. The ideal condition for the collection of railway statistics would be one in which accounts of all railways are grounded on a uniform system of book-keeping. This ideal has been constantly held in mind, and the Statistical Division has always endeavored to work in harmony with the American Railway Accounting Officers' Association, an association having for its chief aim the attainment of uniformity in methods of accounting. The Executive Committee of this Association is at present engaged upon the final revision of the classification of operating expenses, the underlying principles

of which have been already adopted by the Railway Commissioners of the several states. Mention is made of these facts to show the direction in which the railway statistics are moving in the United States.

Confining my remarks to the Interstate Commerce Commission, the entire attention of the Statistical Division has not, however, been addressed to the development of a more perfect form of report and of accounts. A few steps have been taken in what primarily may be termed "scientific investigation." Although the character of the Commission and the limited funds at its disposal have prevented it from entering upon many investigations of great promise, the barrier to progress occasioned by the small amount of money assigned to the Statistical Division has been in part overcome by the fact that the Superintendent of the Eleventh Census considered it wise to place the Division of Transportation under the direction of the Statistician of the Interstate Commerce Commission. This has resulted in making the two offices, to a certain degree, supplemental to each other. I speak of this because the line of facts to which I purpose calling your attention are in part the work of the Census Office, and as they have not yet been formally published it is appropriate to make special mention of the source from which they come.

In 1890 the first attempt was made to classify railway statistics by territorial groups. The necessity of some classification of this sort will be readily recognized. In a country which extends from the Atlantic to the Pacific, and from the Great Lakes to the Gulf; which has all varieties of climate; which produces cotton, tobacco, rice, meats, wheat, corn, and all other cereals with equal facility; which contains all the minerals and nearly all the woods; which has developed manufacturing in all of its forms, and in which manufactures are highly localized; and, lastly, which is more perfectly supplied with railway facilities than any other country in the world (the great variety of its industries and extent of its

territory taken into account); — in such a country, I say, an average of any line of facts cannot be regarded as a type of anything in particular, because the facts from which the averages are deduced are too various, and contain too many anomalous units. To show that this is true I insert here a table taken from the Report of Railway Statistics for the year 1890, published by the Interstate Commerce Commission, giving for the various groups into which the territory of the United States is divided certain averages fundamental in railway statistics.[1] (See next page.)

It requires but a glance at this table to perceive how large a class of statistical problems present themselves for consideration. Each column in the table suggests a separate problem. Without speaking specifically of each set of facts, however, I desire to call your attention to the average revenue

[1] The territorial groups referred to in the table may be roughly described as follows: —

GROUP I. This group embraces the states of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut.

GROUP II. This group embraces the states of New York, Pennsylvania, New Jersey, Delaware, and Maryland, exclusive of that portion of New York and Pennsylvania lying west of a line drawn from Buffalo to Pittsburg *via* Salamanca, and inclusive of that portion of West Virginia lying north of a line drawn from Parkersburg east to the boundary of Maryland.

GROUP III. This group embraces the states of Ohio, Indiana, and the southern Peninsula of Michigan; also that portion of the states of New York and Pennsylvania lying west of a line drawn from Buffalo to Pittsburg *via* Salamanca.

GROUP IV. This group embraces the states of Virginia, North Carolina, South Carolina, and that portion of the state of West Virginia lying south of a line drawn east from Parkersburg to the boundary of Maryland.

GROUP V. This group embraces the states of Kentucky, Tennessee, Mississippi, Alabama, Georgia, Florida, and that portion of Louisiana east of the Mississippi River.

GROUP VI. This group embraces the states of Illinois, Wisconsin, Iowa, Minnesota, the Northern Peninsula of the state of Michigan, and that portion of the states of North Dakota and South Dakota and Missouri lying east of the Missouri River.

GROUP VII. This group embraces the states of Montana, Wyoming, Nebraska, that portion of North Dakota and South Dakota lying west of the Missouri River, and that portion of the state of Colorado lying north of a line drawn east and west through Denver.

GROUP VIII. This group embraces the states of Kansas, Arkansas, that portion of the state of Missouri lying south of the Missouri River, that portion of the state of Colorado lying south of a line drawn east and west through Denver and the territories of Oklahoma Indian Territory, and that portion of New Mexico lying northeast of Santa Fe.

GROUP IX. This group embraces the state of Louisiana, exclusive of the portion lying east of the Mississippi River, the state of Texas, exclusive of that portion lying west of Oklahoma, and the portion of New Mexico lying southeast of Santa Fe.

GROUP X. This group embraces the states of California, Nevada, Oregon, Idaho, Washington, and the territories of Utah, Arizona, and that portion of the territory of New Mexico lying southwest of Santa Fe.

SUMMARY OF SELECTED ITEMS, BY GROUPS.

Territory Covered.	Gross Earnings per Mile of Line.	Operating Expenses per Mile of Line.	Locomotives per 100 Miles of Line.	Men Employed per 100 Miles of Line.	Passenger Mileage per Mile of Line.	Freight Mileage per Mile of Line.
Group I.....	$10,444	$7,075	28	716	233,530	383,505
Group II.....	15,829	10,275	46	1,167	183,121	1,348,107
Group III....	7,785	5,322	24	576	85,572	793,763
Group IV....	4,279	2,886	13	379	43,039	330,981
Group V.....	4,945	3,278	14	386	46,869	304,936
Group VI....	5,195	3,324	15	359	50,059	376,403
Group VII...	5,128	3,007	12	328	46,148	269,866
Group VIII..	4,056	2,613	12	307	37,027	243,753
Group IX....	4,331	3,278	11	303	33,561	245,732
Group X.....	5,836	3,871	13	250	67,196	191,806
United States	6,725	4.425	19	479	75,751	487,245

Territory Covered.	Revenue per Passenger per Mile.	Revenue per Ton per Mile.	Per Cent of Passenger Earnings to Total Earnings.	Per Cent of Freight Earnings to Total Earnings.	Value of Railway Property per Mile of Line, Computed at 5 per Cent on Basis of Earning Capacity.
	Cents.	*Cents.*			
Group I.....	1.912	1.373	47.50	51.36	$57,867
Group II.....	2.029	.828	27.33	70.28	107,741
Group III.....	2.199	.695	28.72	69.35	45,941
Group IV.....	2.481	.844	30.94	66.93	25,177
Group V.....	2.465	1.061	29.16	67.77	30,206
Group VI.....	2.226	.961	26.87	70.97	36,406
Group VII.....	2.452	1.360	27.46	71.19	38,136
Group VIII.....	2.268	1.152	25.96	69.99	27,168
Group IX.....	2.583	1.303	23.88	74.42	14,593
Group X.....	2.308	1.651	34.85	61.74	22,672
United States.....	2.167	.941	29.41	68.23	42,374

per ton per mile in the several territorial groups, which varies, it will be observed, from .695 cents in Group III to 1.651 cents in Group X. Are there any figures at command which serve to explain in any degree this variation? It is this question to which I now invite your attention.

The factors generally accepted as determining railway charges are: physical characteristics of railways, the commercial condition under which transportation is carried on, and

the competitive condition to which railways are exposed. To measure the relative influence of these elements presents a practical problem of the utmost importance, and at the same time a scientific problem which commands the interest of statisticians. It is, indeed, the peculiar function of statistics to solve such a problem.

The importance of physical characteristics, the most significant of which are gradients, curves, and distance from coal supply, has been greatly overestimated, and it has been one of the results of recent railway statistics in this country to show that engineers have committed the error of laying too great stress upon curves and grade. I need not dwell upon this fact, for a glance at the average receipts per ton per mile for the ten territorial divisions, and a mental review of the relative difficulty in railway construction in them, will convince one that physical characteristics of lines cannot exert a great influence upon railway rates. We may then pass this factor without further consideration.

Under the head of commercial conditions, under which transportation is carried on, there are included quite a number of distinct and varying factors. Speaking generally, these are density and character of population served by railways, and the amount, density, and character of freight hauled. All these factors are capable of comparative measurement. Omitting, for the moment, the kind of freight peculiar to the various groups, the facts which throw light upon their commercial character are presented in the following table, which shows for each group the number of miles of railway, the population, the number of miles of line per 10,000 inhabitants, the number of miles of line per 100 square miles of territory, the amount of traffic measured in tons, the amount of traffic per inhabitant measured in ton miles, the density of traffic, the density of load, the average haul per ton as reported by the roads, and the percentage of freight received from connecting lines, and consequently calling for no loading expenses. There is also added to the table the rate per ton

per mile for each group, being the figures that are to be explained.

SUMMARY SHOWING COMMERCIAL CONDITION UNDER WHICH RAILWAYS WERE OPERATED, BY GROUPS, FOR YEAR ENDING JUNE 30, 1890.

Territory Covered.	Ton Miles per Inhabitant.	Ton Miles per Mile of Line.	Number of Tons in Train.	Average Haul per Ton.	Per Cent Freight Received from Connecting Lines.	Revenue per Ton per Mile.
						Cents.
Group I	606	383,505	122.29	69.04	51.00	1.373
Group II	1,688	1,348,107	218.26	96.59	52.00	.828
Group III	1,977	793,763	217.58	120.94	57.00	.695
Group IV	579	339,981	161.92	170.20	37.00	.844
Group V	534	304,936	138.49	107.11	38.00	1.061
Group VI	1,401	376,403	148.29	155.40	24.00	.961
Group VII	1,658	269,866	150.28	167.83	47.00	1.360
Group VIII	1,049	243,753	148.49	172.01	45.00	1.152
Group IX	659	245,732	123.70	224.08	36.00	1.303
Group X	831	191,806	123.04	193.55	27.00	1.651
Total, United States	1,213	487,245	175.12	119.72	48.00	.941

Territory Covered.	Miles of Line.	Population.	Number of Miles of Line per 10,000 Inhabitants.	Number of Miles of Line per 100 Square Miles of Territory.	Number of Millions of Tons Carried.
Group I	6,877.67	4,700,745	12.06	11.09	41.25
Group II	18,613.82	13,767,388	13.52	17.18	240.58
Group III	21,718.27	8,394,816	25.88	17.25	137.20
Group IV	9,032.08	4,945,827	18.28	6.49	16.84
Group V	18,635.09	9,059,032	20.59	6.22	45.20
Group VI	37,463.44	10,263,750	36.52	10.07	92.51
Group VII	8,886.93	1,433,888	62.02	2.15	14.16
Group VIII	20,355.20	4,919,929	41.45	5.57	30.00
Group IX	9,854.18	2,976,630	33.16	3.04	8.76
Group X	12,160.37	2,339,566	52.18	1.60	10.04
Total, United States	163,597.05	62,801,576	26.05	5.51	636.54

A word of explanation may be necessary for the correct interpretation of the figures in the columns headed: The Average Haul per Ton, and Percentage of Freight Calling for no Loading Expenses. The average haul per ton for each

group is determined by dividing the aggregate of ton-mileage in each group by the total number of tons reported as carried. For each group taken by itself the averages of the table are correct if the figures are properly interpreted. For the United States as a whole, however, the true average haul per ton is 220 instead of 119 miles. The figure 119 is obtained by dividing the total ton-mileage by 636 millions of tons of freight, which is the aggregate of freight carried, as reported by all the lines. A classification of this freight has been made in the Census Office from which it appears that only 330 millions is taken up by the roads at their stations, the remainder being received from connecting roads. This shows that the true basis of railway operations is much nearer 330 millions of tons than 636 millions of tons, and that this figure should be accepted as the divisor in determining the average length of haul for each ton in the United States. The significant fact, so far as the cost of transportation is concerned, is that tonnage received from connecting roads is usually the occasion of no loading expenses, and, in the last column of the above table, I have made an estimate of the proportion of freight calling for no loading expenses in each of the several groups, using as the basis of this estimate the amount of freight reported in each group as originating on the line of the company making report, and the amount reported as received from connecting lines. With this explanation the figures in the above table may, I believe, be easily understood.

An expert might, perhaps, be able to read from a large number of averages in the above table the statistical law which they contained. In order, however, to render this task more easy I have subjected the most important data to a different arrangement. Thus, the table next inserted shows the order in which the several groups stand when arranged according to a plan of progression. For the purpose of explanation it will be observed that in the column headed "Revenue per Ton per Mile," the groups are arranged in order,

beginning with the group which shows the smallest and ending with the group which shows the largest revenue per ton per mile. In the other columns the order of progression is inverse to the density or quantity or significance of the factor considered.

The first fact which a consideration of the above table impresses is the remarkable coincidence between density of traffic and the number of railways per 100 square miles of territory, as shown by the order in which the groups arrange themselves in the second and third columns. Upon the basis of this exhibit one may with confidence assume that density of traffic and railway facilities are interchangeable terms.

Further observation discloses a certain degree of uniformity in the recurrence of the remaining items, and in their assignment to the revenue per ton per mile. To indicate this I have connected by lines several of the groups in the various columns of the table. Thus it will be observed that Groups II, III, V, IX, and X exhibit a fair degree of uniformity in the order in which they appear in the several columns of the table, so much so, indeed, that we are authorized to lay down, at least hypothetically, the law that railway charges vary according to the commercial conditions implied by the density of traffic, density of load, and exemption from loading expenses.

Of the groups which vary from this rule it will be observed that Groups IV and VI vary on account of the item, exemptions from loading expenses. In Group VI, for example, which in density of traffic and density of load stands third in order, one would be justified, I think, in saying that it would also stand third in revenue charges were it not for the high average of loading expenses which the railways of this group sustain. Group I, that is to say, the New England states, exhibits the greatest fluctuation, but the railways in this group in every particular stand apart from the railways of the other parts of the country. They are the only railways of the entire country which depend largely upon passenger as

compared with freight traffic, and they are also exempt, in large measure, from the competition to which other roads are exposed.

Group VIII shows a lower rate per ton per mile than might have been expected, while Group VII may be accepted as conforming fairly well to the general rule, if it be noticed that because roads of this group do not show either density of freight or density of load, the high relative charge for loading can bear but slight relative importance.

There is another very important commercial condition not represented in the above tables which must be noticed. I refer to the character of the freight carried by the railways of the various groups. In the following table, presented by courtesy of the Census Office, the total freight carried by the railways of the United States during the year 1890 is classified as products of agriculture, products of animals, products of mines, products of forest, manufactures, merchandise, and miscellaneous.

SUMMARY EXHIBITING THE FREIGHT TRAFFIC BY COMMODITIES OF THE RAILROADS OF THE UNITED STATES IN THE YEAR ENDING JUNE 30, 1890. ALL GROUPS.

Commodities.	Totals for United States.				
	Freight Originating on all Roads.	Freight Received from Connecting Lines and Other Carriers.	Unsegregated Tonnage.	Total Freight Tonnage.	Per Cent.
	Tons.	*Tons.*	*Tons.*	*Tons.*	
Totals	274,112,866	258,981,868	107,357,814	640,452,548	100.00
Products of agriculture	28,865,536	41,041,868	16,629,253	86,536,657	13.51
" " animals	10,497,285	11,680,799	4,249,944	26,428,028	4.13
" " mines	129,977,648	115,244,678	26,323,374	271,545,700	42.40
" " forest	32,674,105	21,714,792	9,409,288	63,798,185	9.96
Manufactures	37,093,806	34,929,964	7,927,000	79,950,770	12.48
Merchandise	12,946,615	10,900,392	5,899,806	29,746,813	4.65
Miscellaneous (commodities mentioned above)	22,057,871	23,469,375	36,919,149	82,446,395	12 87

The Census Office made a computation similar to the one presented in the above table for the United States for each of the territorial groups. In place, however, of producing these figures entire there will be found in the table on next page a statement of the aggregate number of tons carried in each group, and the percentage of each class of freight to this aggregate. There is also inserted a map of the United States which makes a graphic exhibit of these data.

Unless one's attention has been called to an analysis of railway freight, he will, I venture to say, be somewhat surprised at the above presentation. The average rate per ton per mile on all the railways of the United States is .860 cents. We have already discovered one reason for this apparently low rate in the fact that the average haul per ton is 220 miles, and now another reason for this low rate appears in the fact that by far the greater per cent of freight is low grade freight. Thus, agriculture, animal products, mines, and forests account together for nearly 75 per cent of total freight carried. Mines supply the railways with nearly 50 per cent of their total traffic.

The problem which we have set before us, however, pertains to the relative rates in the various groups, rather than the actual rate in the United States as a whole, and, without making a particular analysis of the freight carried in each group, a casual glance will show that this is a very important element in the making of rates. In Group II over 60 per cent of the total freight is the product of mines, and in Group III over 40 per cent, but in Group III forestry, agriculture, and animal products, low class freight, show a higher percentage than in Group II. This, taken in connection with the fact that Group III is most favorably situated of any group in the country as regards expense of loading, and, also, with the fact that railways within this group running north and south are heavily loaded with mineral products in both directions, fully explains why the average receipts per ton per mile are lower than in any other group. It is possi-

TABLE SHOWING RELATIVE AMOUNT OF FREIGHT, OF CLASSES NAMED, MOVED BY RAILWAYS IN THE SEVERAL TERRITORIAL GROUPS; ALSO AGGREGATE NUMBER OF TONS MOVED.

Class of Commodities.	Group I.	Group II.	Group III.	Group IV.	Group V.	Group VI.	Group VII.	Group VIII.	Group IX.	Group X.	The United States.
Agricultural products.....	10.14	8.40	13.62	14.07	15.88	20.55	18.96	23.76	20.39	21.24	13.51
Animal products.....	4.15	2.50	4.46	2.70	2.49	5.57	7.01	9.55	11.30	5.00	4.13
Mineral products.....	14.63	60.35	42.66	35.15	22.79	31.02	21.40	32.62	16.23	19.83	42.40
Forest products.....	6.05	6.65	12.13	16.10	12.16	10.87	9.15	12 82	25.09	18.49	9.96
Manufactures.....	7.60	13.67	17.68	15.69	11.92	7.60	5.14	4.57	9.83	11.52	12.48
Merchandise.....	7.38	2.89	4.69	6.56	5.62	5.12	3.83	8.11	9.46	15.20	4.65
Not classified.....	50.05	5.54	5.36	9.73	29.14	19.27	34.51	8.57	7.70	8.42	12.87
Aggregate number of tons carried.....	39,475,504	237,293,176	139,372,456	19,215,102	44,382,018	94,036,235	13,625,381	31,587,663	11,398,302	10,066,711	640,452,548

ble, also, that the competition which the railways of this group sustain with lake traffic has something to do with its low rate, although my personal opinion is that lake traffic is a less important element in forcing down railway rates than is commonly supposed. The truth is that steam vessels have forced sailing vessels to the wall, and the railways have captured the steam vessels.

I shall not extend this paper for the special analysis of the traffic of each group, but I cannot refrain from calling your attention to group IV. It is somewhat surprising that the receipts in this group are lower than in all other groups, with the exceptions of Group II and Group III. There is nothing in the commercial conditions to justify such low rates, and it is quite likely that this group is influenced more largely by water competition than any other in the United States.

This paper must be regarded as a contribution to the solution of the problem of railway rates. It certainly is not conclusive respecting them. It is believed, however, that it follows the logical order of treatment in that it endeavors to give a comparative measurement of the commercial conditions under which railway traffic is carried on, assuming that what, in this manner, cannot be explained must be referred to the financial condition of the various railways, and to the competitive conditions under which they are operated. The facts which it contains are the latest contributions to railway statistics in the United States.

I cannot close, however, without the suggestion that a schedule of rates which holds in mind the commercial and industrial interests of the public must adjust itself to the character of the industries whose products the railways carry. An investigation into the localization of industries, and the amount of various kinds of traffic originating in the several sections of the country, should be the basis upon which railway rates are adjusted.

THE CONDITION AND NEEDS OF STATISTICS OF MARRIAGE AND DIVORCE.

By Rev. Samuel W. Dike, LL.D., Auburndale, Mass.

This paper will offer some suggestions from the point of view of a student of the social problems of Marriage and Divorce. I am at present unable to carry out my original intention of presenting with it an exhibit of just what is done in the official statistics of various countries and states, together with a table showing the movement of marriages and divorces for the last twenty-five years. The great courtesy of many chiefs of European bureaus of statistics has supplied me not only with their recently published reports, but in most instances with the latest returns in manuscript. I am also under the greatest obligation to these officials for useful answers and suggestions in response to inquiries regarding the present condition of their statistical work in this particular field, and the improvements which they think should be made in it.

The importance of statistics of this class needs no argument. Statistics of Marriage and Divorce find their justification in their relation to the family, since they note its formation and dissolution. Those relating to marriage have, as a rule, been longer and more widely collected in Europe than those of divorce. In the United States statistics of divorce were collected in only a few states until the investigation, which was the basis of the Report of 1889, was made. These, as regards the number and some other leading facts, were practically complete for twenty years. But the statistics of marriage could be gathered for only a few states, and, unfortunately, at present only twenty-one states make any provision for the returns of marriages to any state officer, and but nine furnish statistics of divorce.

Among those who have studied the moral and political

aspects of divorce, Von Oettingen and Woolsey collected statistics for comparative study. But the paucity of official statistics and obstacles in the way of private research greatly restricted their laborious efforts. Sig. Bodio and M. Bertillon were the first among official statisticians to do important work in bringing together the divorce statistics of various countries. A few years later Mr. Wright, the Commissioner of Labor of the United States, acting under a special instruction from Congress to undertake the task, collected from original sources complete statistics of the fundamental facts concerning divorce in the United States for the years 1867–86 with such statistics of marriage as were available. He also brought together, chiefly from the original sources, the statistics of both marriage and divorce in most European countries and Canada. The value of this work was greatly increased by the analyses of the laws relating to those subjects so far as legislation throws light upon the statistics.

The work of Mr. Wright, in a volume of 1074 pages, brought together a vast amount of material for the study of the social and legal aspects of the problems relating to Marriage and Divorce, which, in the United States at least, have become of the greatest importance from the easy conditions of marriage and divorce, the great number and rapid increase of divorces, and the conflicting character of our state laws. Its value is already seen in the abandonment, for the present certainly, of the plan of uniform law through an amendment of the Constitution of the United States, for the experiment of uniform legislation by the coöperation of the state legislatures. For the Report showed that the facts regarding migration for divorce were almost the reverse of the popular opinion. But beyond this it has advanced statistical study of the subject in a way that shows the need of carrying the investigation in this country still farther, and the value of statistics for comparative study upon its subjects in all civilized countries. Anyone who carefully looks into the matter can hardly fail to see that the tendencies of the laws on marriage and

divorce, amid all their variety, have already been converging towards the adoption of certain common principles and points, and that the growing intimacies of the nations will lead to greater uniformity. The statistics of Japan, the numbers of whose marriages and divorces are now reported for the seven years 1884–90,* and the fact that the swift movements of that people towards Western civilization are being made while its domestic institutions are not yet brought under public law, and the significant changes in the divorce laws of Australia and France, with the wide spread disposition to challenge traditional authorities and conclusions, will all tend to increase the demand for the investigations and reports of the statistician.

On these subjects the student of social problems and the legislator and reformer will be best aided if each statistical office will use its resources for the collection and presentation of all the facts within its own field. Uniformity of method and form are desired rather than uniformity in the points included within the investigation, for everything has its value. The omission of a single point for a year or two may greatly disturb the student, or take away his only source of exact information on that particular point. The tabulation of first marriages, by age and sex, for a long period, for example, enables him to detect the difference in the comparative increase of the age at which the two sexes marry. Or the returns of deaths may give conjugal condition and thus show the number of marriages dissolved in a year by death as well as the death rate among the married and divorced.

The material for statistics of marriage, and generally the statistics themselves, in most European countries are so very nearly complete as to require little notice. Names, place and

* These are as follows : —

Year.	Marriages.	Divorces.
1884	287,842	109,905
1885	250,497	113,565
1886	315,311	117,964
1887	334,149	110,859
1888	330,246	109,175
1889	340,445	107,478
1890	325,141	100,088

date of birth, the past residence, and sometimes the intended residence, the age, number of the marriage and previous conjugal condition, religious faith, occupation or social position, are generally required in the original returns. The prevalence of the obligatory civil marriage, and the restrictions upon the jurisdiction of the clergy and civil officers, make exact and complete returns comparatively easy.

But in the United States the registration reports of only six or eight states are sufficiently full in detail or complete in returns to be entirely trustworthy, and about as many more are approximately complete. Only twenty-one states in 1886, as already mentioned, provided for any returns of marriages, and, as the report of Mr. Wright says, "These returns, as a rule, however, give but a few facts relative to the persons married, and these facts that are given are not identical, and are compiled so carelessly as to be nearly worthless." And he adds, "This report shows conclusively the necessity of complete records of marriages celebrated." The Massachusetts reports, which other states have followed, and those from one or two more, have generally been well made. But our separation of church and state, though curiously permitting the clergyman to be a civil officer for the purpose of celebrating marriages, has allowed us, quite unnecessarily I think, to omit all attempts to report the religious faith of those married. We have asked the occupation, but rarely tabulate the facts regarding it, and we never inquire into economic condition or other facts of social standing. If the time, place, and cause of the dissolution of the former marriage were required of all who marry a second time we should get sociological material of great value. The practice in Germany, and some other countries of Europe, of having each dissolution of a marriage, whether by death or divorce, reported and entered upon the original record of the marriage renders bigamy easy of detection.

In statistics of divorces or separation we should have, where practicable, the age of the parties, their nationality,

race, religious faith, occupation, and perhaps economic condition, residence by town or city, year and month of marriage, of application and decree of divorce, the number, age, and sex of the children of the parties, the dates and causes of the dissolution of all earlier marriages, as well as the sex of the applicant, the grounds on which the divorce or separation is sought and granted, and the number of applications refused. In the United States the length of the entire residence within the state where the divorce is granted, and the facts as to service of notice upon the defendant, should be ascertained. Then the statistics of pauperism, crime, insanity, and suicide should so report conjugal condition that the number of divorced who fall within these classes can be discovered.

So far as practicable I would have special investigations in marriage and divorce carried on to supplement the results of the ordinary periodical statistics. The divorces of Sweden, Belgium, and France are already reported for long periods of time. If these could be supplemented by figures running back for a long time in some other countries, and in some of the United States, we should get a good deal of light upon the relation of the movement of divorce to the great political, economic, and social changes of the period. Special inquiry may also contribute still more knowledge than we now have of the connection between divorce and suicide, intemperance, illiteracy, the home and hereditary conditions. The discussions of Bertillon and others on some of these points are fruitful of suggestions. Prof. Willcox, of Cornell,* has called attention to the apparent coincidences in the movements of trade, immigration, marriage, and divorce in the United States.

I would further suggest that the statistical offices of as many countries or states as may be practicable be invited to coöperate in the effort to secure greater completeness in this class of statistics, and that they or the Bulletins of the International Institute, and other statistical publications, bring together the summaries annually or at other regular periods,

* In the *Political Science Quarterly* for March, 1893.

preserving and continuing the results that have been hitherto secured. Statistical dictionaries and other hand-books should be careful not to vitiate official figures by the interpolation of estimates or mere guesses where the actual figures are unknown. I find, for example, in a popular Dictionary of Statistics an estimate of the divorces of Germany for years prior to those for which we have any official or other figures; an estimate of marriages in each one of the United States from the data supplied by the statistics of a very few of the older states; and, worse yet, a pure guess at the rate of illegitimate births for the United States as a whole. Such figures as these are sure to be quoted, often in reputable publications, as actually correct, or as entirely safe estimates. The general reader has little protection against such imposition.

Finally, I think the influence of statisticians and of public-spirited citizens should be used to secure from governments means of extending statistical work upon these subjects that through their relation to the family deeply concern the greatest social interests. If Great Britain and some other countries would provide for the publication, and in some cases the collection and publication, of statistics of divorce in some readily accessible form, many students would be grateful for the service. But the people in the United States especially need to be urged to bring their statistics of marriage and divorce to a more creditable place beside those of other nations than they now hold. The Commissioner of Labor, in making his Report in 1889, spoke in strong terms of the serious consequences of the careless way in which records of divorce are made and kept, and pointed out some of their defects and the need of a better system for the record and report of the marriage and divorces. His work has laid an admirable foundation upon which a fine system of statistics relating to this most important subject may be constructed. Public opinion should compel legislation that would correct this evil, and at the same time provide for full and trustworthy statistics.

RAILWAY STATISTICS AS APPLICABLE TO EARNINGS OF PASSENGER TRAINS.

By M. Riebenack.

Assistant Comptroller Pennsylvania Railway Company.

Availing myself of the latitude granted by your committee's representative in his letter conveying the information that I had been selected to prepare a paper on "Railway statistics as applicable to earnings of passenger trains, with a view of determining approximate revenue and deciding as to number and time of trains to be run for the accommodation of the public," I shall take the liberty, preliminary to entering upon a discussion of the subject, of making some reference to the accounting and passenger departments of American railways, and their functions as generally organized. These remarks will be of a general and explanatory character, calling attention to past conditions and the rapid growth and development of the railway passenger train service leading to the necessity for current statistics of the character it is proposed to describe.

The demand for reliable figures from which to obtain the earning capacity, as well as the current expenditures of railroads, in detail, was one of the principal causes for the establishment of the accounting department by railway corporations. This department — the auditing bureau — is the one to which railway managers turn for definite information in relation to current, general, and detailed earnings and expenditures of the road. It is there that specific and absolute attention is given to statistical details. This department also handles all data bearing upon the cost of management and operation of the road's various divisions and branches, whether on passenger or freight account, or on general or special business. These latter figures are audited, compiled, and reduced to statement form, in order to meet demands made for

comparative statements showing the cost of operation for any given period.

It is not the purpose to consume time by enumerating the almost infinite variety of items which affect the earnings of the passenger traffic. Past experiments and inventions of man in the mechanism and applications for railway passenger service are undergoing phenomenal evolution, the tendency of which is conspicuously and invariably for insuring safety, speed, and comfort. In a retrospective glance at the improvements and realizations of the last ten years in railroad operation we are at once amazed by the incontrovertible evidences of the great and sweeping advances that have been made in every avenue. Our locomotives are marvels of power and speed, having been brought to what we may almost consider a state of perfection by the inventive genius of the best mechanical minds. The model railway passenger train is a combined masterpiece, embodying the talent and ability of the inventor, car builder, upholsterer, artist, designer, and decorator, possessing sumptuousness, oriental luxury, rich coloring, striking effects, solid comfort, and every possible convenience.

The travelling public today receives from railroad companies for a given sum a much larger equivalent than formerly. It is hardly necessary to call to mind the old-time passenger shed, and the unsightly and uncomfortable cars, that comparisons may be had with today's magnificent railway structures, representing the highest architectural skill and large outlays in money, and the advantages of present car arrangements in such essential matters as heating, lighting, and ventilating, with the increased parlor, dining, buffet, sleeping, and observation car service. These introductions of improved service have largely banished the fatigue and discomfort incident to travel in the not very remote past, and transformed the tiresome railway journey into one of rest and enjoyment. The luxurious ease and unvarying comfort afforded by the famous solid vestibuled palatial cars are ren-

dered doubly enjoyable from the fact that the high speed attained is sustained with almost absolute safety.

Very properly and wisely are we impelled by financial interests to inquire into the means of providing the best train service warranted by the earnings derived from the passenger traffic. Tabulated statements of earnings and expenses, as well as numerous other data, in these closing days of the greatest century of civilization, have become truly wonderful aids to success, requiring the employment upon them of the best skill and ability of statistician and mathematician, under the supervision of railway officials of large experience and practical education.

For the owners of the millions of dollars now invested in railway property these annual or other statements invariably possess intense interest. No railway management should lose sight of the governing fact that the affairs of the company should be conducted in the best interests of its owners, to whom its general financial condition and earning capacity can only be made known through comprehensively and carefully compiled statements. In the past the study and compilation of railway statistics in the United States have not been conducted upon clearly defined lines, as a whole, calculated to produce beneficial or valuable results. On the contrary, they have been largely the creatures of individual preferences, as represented or dictated by the managers of the various roads, by whom they have been accordingly influenced. While some roads have adhered to records based upon similar methods of preparation others have ignored such records, or have been governed by plans totally dissimilar, thus occasioning confusion and rendering them of little value for practical purposes.

The annual joint conferences of the Interstate Commerce Commission and the representatives of the various state railway commissions (inaugurated about five years since) are fast developing a uniform basis for furnishing statistics. The results so obtained, if properly handled, will go far

towards solving what is termed the "railway problem." Divested of the mysticism commonly ascribed to the word "problem," this term "railway problem" means a just basis for rates, a due maintenance of the same, and the permanent establishment of measures preventive of injurious or unreasonable discriminations.

When I entered the passenger service of the Pennsylvania Railroad Company in 1865, one of the most complicated questions vexing and perplexing the operating officers of the road was in the form of petitions and letters from patrons of the line inviting, arguing for, and demanding increased train service, especially at terminal points and principal cities along the road. The Pennsylvania then had a passenger revenue of $6,376,079.14 per annum, and carried 3,611,086 passengers.

Since 1859 there has been in operation a system of daily train reporting by ticket agents, exhibiting the sales of all local tickets. An effort was directed toward the consolidation of train information on the basis of these reports, and approximating the sales of all other kinds of tickets, thereby providing a means of dividing the revenue arising therefrom among the various trains. This plan proved very unsatisfactory, as it required a large clerical force at the company's general office, and it was impossible to obtain the results until months after the business had passed over the line, so that it was finally abandoned and the information desired sought for in other directions.

The devising of more efficient means for this purpose was not pushed to practical completion until another problem confronted the company in the shape of the anticipated heavy travel incident to the Centennial Exposition in Philadelphia in 1876. Finding that the then limited number of passenger trainmen would be unable to cope with the increased volume of passenger business during that exposition it was suggested that freight crews could be pressed into passenger service. This suggestion was embarrassed by the fact that those

employes were not competent to deal with the various complications and limitations incident to the tickets then in use. The company met the question in the fall of 1875 and spring of 1876 by the employment of young men who had previous experience in commercial life, to whom were given full and complete instructions respecting the kinds, conditions, and peculiarities of tickets, with a view to engaging their services solely for the collection of tickets and fares on trains. They were drilled also in the knowledge of time-tables, the baggage checking system, and other duties requiring intelligence and reliability in their relation to passengers. These employes were known as "train agents," to distinguish them from conductors, the latter being in full charge on the train with the former as aids. The selection of train agents was made on the basis of gentlemanly appearance and deportment, as well as clerical ability, which would equip them acceptably for contact with the travelling public. One of their most important duties was the preparation of reports exhibiting in detail the entire travel on the several trains, thus furnishing the solution of the problem as to the obtaining of satisfactory train information.

To further the handling of the business, and improve the character of reports of the traffic, there was inaugurated a system of "ticket receivers." Competent men, selected from the general office staff and designated as ticket receivers, were appointed and placed at terminal or other important stations to receive cash and ticket collections from conductors and train agents, to make up statements of the business and money value of each run made, and to adjust differences with passengers, which were unavoidable under the pressure of so large a business of a new character coming on the line.

At the close of the Centennial Exposition there arose the question of the advisability of continuing the service of train agents, or returning to the old system of conductors. Economic features largely influenced the decision of this question, which resulted in the restoration of the former system

of conductors, but under changed conditions. The ticket receivers' system was continued and extended under enlarged powers, and a high standard of qualification required of parties in charge of such offices.

The ticket receivers, as well as the clerks in their offices, receive a thorough training in the auditor's office before appointment to the position, so as to be well versed in all the rules and regulations of the department connected with the business of passenger transportation, have a geographical knowledge of railroads and connecting points, and possess good judgment to the end that their decisions pertaining to the validity of tickets, or other matters about which there may be a disagreement among passengers and conductors, shall be equitable as between passengers and the company.

The conditions under which conductors were assigned to passenger trains were also changed, and a higher grade of efficiency demanded. In addition to passing an examination from a transportation standpoint, they are now required to be instructed and to pass an examination in the auditor's office, to demonstrate their qualifications for accounting duties, before they are placed in charge of passenger trains. They must prove themselves possessed of fair education, good clerical abilities, and a thoroughly practical knowledge of the classes and conditions of tickets which are presented on trains as equivalents for rides, and must have an intelligent conception of any and all relations that may arise among passengers and the company. As a result of the instructions given and a subsequent examination they are classified and graded. Those passing No. 1 or No. 2 are assigned the most important runs; those passing No. 3 are assigned to such runs as do not offer so great variety and complication in tickets and information.

Illustrative of the increased knowledge necessary — owing to the expansion of territory and variety of travel — for the proper handling of train business, the following comparative table is given, showing the classes of tickets in use in the current year, 1893, as contrasted with those of 1872: —

LOCAL.—As Applicable to Traffic Originating at and Destined to Points on Same Line.

1893.	1893.—*Continued.*	1872.
Regular.	54-trip employes'.	Regular.
2nd class.	60-trip.	Commercial.
Accommodation.	60-trip employes'.	Accommodation.
Special.	Quarterly.	Accommodation special.
Special employes'.	Quarterly employes'.	Special.
Strip.	Strip employes'.	Emigrant.
Limited.	Workmen's.	Emigrant special.
Continuous passage.	Workmen's 50-trip.	Clerical.
Clerical.	Workmen's 54-trip.	Excursion.
Excursion.	Annual.	Excursion special.
Excursion comb. and seashore.	100-trip season.	Excursion summer.
	100-trip annual.	10-trip.
Excursion special.	150-trip.	12-trip.
Excursion two-day.	150-trip season.	18-trip.
Excursion five-day.	150-trip season, employes'.	25-trip.
Excursion employes'.	300-trip annual.	16-trip.
Excursion summer.	360-trip.	26-trip.
Excursion summer special.	Irregular commutation.	30-trip.
10-trip workmen's.	Parlor car.	46-trip.
10-trip.	Street car (agents).	50-trip.
20-trip employes'.	Regular conductors'.	54-trip.
25-trip.	Accommodation conductors'.	Quarterly.
26-trip.	Clerical conductors'.	Commutation.
46-trip.	Excursion conductors'.	Regular conductors'.
46-trip employes'.	Excursion two-day conductors'.	Special conductors'.
50-trip.	Street car conductors'.	Emigrant conductors'.
50-trip employes'.	Parlor car conductors'.	Excursion conductors'.
50-trip special.		75-trip.
50-trip season.		100-trip.
54-trip.		Employes' Commutation.

INTER-ROAD.—As Applicable to Traffic Originating on a Certain Line and Destined to Points on Another Line.

1893.	1893.—*Continued.*	1872.
First-class.	Excursion summer special.	First class.
Limited.	Excursion winter.	Second class.
Second-class.	Excursion winter special.	Special.
Special.	Excursion comb. and seashore.	Emigrant.
Clerical.	Commutation.	Excursion.
Emigrant.	Mileage.	Commutation.
Excursion.	Extra fare.	Extra fare.
Excursion special.	Penna. R. R. Parlor car.	Accommodation.
Excursion employes'.	N. Y. & L. B. R. R. parlor car.	
Excursion summer.		

INTER-ROADS.— As Applicable to Traffic Originating on Another Line and Destined to Points on a Certain Line.

1893.	1872.
First-class.	First-class.
Special.	Special.
Special time.	Emigrant.
Special time second-class.	Excursion.
Clerical.	Excursion special.
Emigrant.	Extra fare.
Excursion.	Second-class.
Excursion special.	Accommodation.
Commutation.	
Extra fare.	

MISCELLANEOUS.— Covering Tickets Used for Articles Carried in Baggage Cars, and for Passing Teams and Passengers Over Ferries and Bridges.

1893.	1893.—*Continued.*	1872.
Mail wagons.	Marketing, conductors'.	Mail wagons.
Express wagons.	Bridge.	Express wagons.
Extra baggage, local.	Package stamps, local.	Extra baggage, local.
Extra baggage, inter-road.	Package stamps, inter-road.	Extra baggage, inter-road.
Milk, local.	Package.	Extra baggage, emigrant.
Milk, inter-road.	Ferry, passengers.	Milk, local.
Milk, conductors'.	Ferry, teams.	Marketing, local.
Cream, local.		Ferry collection.
Cream, inter-road.		Incidental.
Marketing, local.		Bridge tolls.

The summary of the various forms of tickets for the years named shows as follows: —

	1893.	1872.
One-way, ...	39	24
Excursion, ...	23	9
Commutation, ...	35	18
	97	51

The basis of the plan now in use on the Pennsylvania Railroad system, under which the earnings of the several trains are computed, is the conductors' trip report of the tickets honored, of which the following is a sample: —

PENNSYLVANIA RAILROAD COMPANY.

Mileage of Tickets on Train No. 3, from New York to Philadelphia, on.....day the .....day of.....189 .

Run by.....Conductor.

Kind of Ticket.	From.	To.	On.	Off.	Number.	Distance.	Miles.

Cash Received, ... $.....
Deduct Cash not Earnings, ...
Passengers and Net Cash, ...
Total Pay Passengers, . . . $.....

Free Passengers.	Complimentary.	Legislative.	Editorial.	Employe.	Pay Passengers.
Annual Passes...					From Jersey City.
Term Passes.....					To Philadelphia.
Trip Passes.....					

Made by..... .....
Examined and Correct.....Ticket Receiver.

A brief description of this blank may be interesting. It exhibits the kind and reading of the tickets used, whether lifted or not, the passenger mileage accruing therefrom to the particular train or run, represented by the report, the net amount for the train from the conductors' cash collections, the total passengers carried on the trip, and also a statement of free passengers carried on the several kind of passes, and the total passengers on train when arriving or departing from important terminals. These reports are delivered by the conductors to the ticket receivers, who consolidate the information for all trains in a daily statement to the accounting department in the following form : —

PENNSYLVANIA RAILROAD COMPANY.

Statement of the Mileage for all Passenger Business of Trains Reported at Ticket Receiver's Office, at Philadelphia, for the.....day of.....189 .

.....Ticket Receiver.

Train.	From	To	Passengers.	Mileage.			Cash.	Remarks.
				Local.	Foreign Inter-Road.	Foreign Roads. Inter-Roads.		
3	New York	Philadelphia						
5	"	"						
7	"	"						
9	"	"						
21	"	"						
23	"	"						
25	"	"						
27	"	"						
35	"	"						
41	"	"						
43	"	"						
45	"	"						
47	"	"						
49	"	"						
51	"	"						
55	"	"						
57	"	"						
59	"	"						
63	"	"						
65	"	"						
71	"	"						
73	"	"						
75	"	"						
79	"	"						
81	"	"						
83	"	"						
85	"	"						
89	"	"						
91	"	"						
93	"	"						

The ticket mileage comprised in the Ticket Receiver's statement is utilized in the general office in the preparation of the weekly estimate of passenger earnings, and, as the number of passengers, cash and ticket mileage for each train are also shown separately, it is then used in the compilation of the monthly statement of train earnings, on form following: —

PENNSYLVANIA RAILROAD COMPANY.

Statement of the Number of Passengers Carried, and Earnings Therefrom, on Through Trains from New York to Philadelphia, for the month of..... .....189 .

Train.	From	To	Trips.	Passengers.	Earnings.	Average Earnings.	
						Per Trip.	Per Mile Run.
3	New York.	Philadelphia.					
5	"	"					
7	"	"					
9	"	"					
21	"	"					
23	"	"					
25	"	"					
27	"	"					
35	"	"					
41	"	"					
43	"	"					
45	"	"					
47	"	"					
49	"	"					
51	"	"					
55	"	"					
57	"	"					
59	"	"					
63	"	"					
65	"	"					
71	"	"					
73	"	"					
75	"	"					
79	"	"					
81	"	"					
83	"	"					
85	"	"					
89	"	"					
91	"	"					
93	"	"					

The number of conductors' trip reports, of tickets honored, made during the month of July, 1893, was 52,500, covering the running on the several divisions of about 2850 trains, carrying 5,935,400 passengers, with earnings of $2,323,450, while the number of ticket receivers' consolidated statements received during the month, and which must be handled in the general office in the compilation of the weekly estimate and train-earning statements, amounted to 584, or, say, twenty-three each working day.

Through the operation of this system the accounting department is enabled to promptly lay before the transportation officers and others interested monthly statements, showing the number of passengers carried, and the total earnings and average earnings per trip and per mile run for each and every train on which passenger business was moved. The method followed in the general office in the preparation of the train-earning data is to transfer to specially prepared sheets the daily business of the several trains as exhibited by the statements from the respective ticket receivers, and at the end of the month totals are made for each train of the passengers, ticket mileage, and cash collections. To the ticket mileage is then applied the average rate per mile which the actual business for the preceding month shows to have been received from passenger traffic. To the data thus obtained is added the number of passengers and amount of earnings from such of the card commutation ticket travel as is not shown on the reports rendered by conductors running on lines in certain populous districts, by reason of the impossibility of obtaining the necessary record on such trains, and which is consequently not included in the ticket receivers' statements. This commutation travel is apportioned to the several trains on the basis of percentage, arrived at by special records, taken from time to time, of the actual amount of this travel carried on the respective trains, which percentages are applied monthly to the sales as shown by agents' reports. After the total earnings for the month have been arrived at, computations are made of the averages per trip and per mile run, and the information is then transferred to the final sheets for distribution to the officers interested.

The utility of the train-earnings statement as a means of information is beyond question. The comprehensive and accurate data it conveys is of signal service to the transportation officers in many respects, notably in connection with the arrangement of train service and the distribution of the car supply. It is likewise of great value as a means of com-

parison, extending from month to month or year to year, that will infallibly indicate — by the increase or decrease of the travel in given territories or on established lines — the portions of road requiring attention and fostering care, and will show as well the results of any measures that may have been taken for the promotion of the passenger traffic. In accordance with modern ideas it is considered absolutely necessary that the managers of railroads be kept informed, at frequent periods, as to the business actually being done on their lines. The means by which this is accomplished on the Pennsylvania Railroad system is the weekly estimate. Under the present system of train earnings the passenger data necessary in connection with the estimate are easily and expeditiously collected from the ticket receivers' daily statements, on which is exhibited in consolidated form the information shown on the conductors' reports of the travel on the respective trains.

It has been my experience that the making of ticket-mileage reports by conductors has been of decided advantage to them and benefit to the service. The handling of tickets, necessary in arranging them for entry on the reports, tends to keep the conductors familiar with their appearance and privileges, and serves also as a means of education of such of their crew as may be called upon to assist in the making of these reports; also, the entry and extending of the mileage familiarize the conductors with the distance between stations on their runs, knowledge of which is of great value to them in connection with the honoring of mileage tickets. Numerous other advantages are connected with the train reports, such as, for instance, tracing tickets, determining the class of travel on the several portions of road, keeping conductors in touch with ticket receivers, and through them with the accounting and passenger departments, etc.

Since the value of the train-earning system has been proved by the experience of the Pennsylvania Railroad Company, its example has been followed by other lines, and the same

plan adopted thereon, either in its entirety or in a modified form.

In conclusion, it may be proper for me to state that, while the above system is of great value and importance to a railroad like the Pennsylvania, whose passenger service on its lines east of Pittsburg covers annually over 618,000 trips of trains, carrying 64,000,000 passengers, with a gross revenue from same of $24,000,000, and whose equivalent of passengers carried one mile was, in 1892, 1,168,750,000, the expense involved in establishing ticket receivers' offices and train reporting would be too great for many roads, and only justifiable in such as have a large passenger business. Two conditions seem necessary to obtain satisfactory results for the expense involved: —

First. The railroad's passenger business must be of sufficient volume for the estimate of its train earnings to become a factor in the adding or withdrawal of passenger trains.

Second. That the information be also used for estimating current earnings weekly or oftener in advance of final audit of earnings from passengers.

COMPARABILITY OF TRADE STATISTICS OF VARIOUS COUNTRIES.

By A. E. Bateman, C.M.G.

This is the fourth occasion on which the subject of comparative statistics of international trade has engaged the attention of the International Statistical Institute, but I regret to say that we have not yet arrived at complete accord.

It will be remembered that the chief points to which the attention of your committee has been directed are the following: (1) The valuation of imports and exports; (2) the registration of the origin of imports and of the destination of exports; (3) the classification of the articles of import and export.

As to (1) there has been little difference of opinion. The system in force in the United Kingdom for many years of valuing both imports and exports according to the declarations of importers and exporters has been approved, chiefly because it is the only possible way of showing the monthly imports and exports at the values of the month to which they relate. The approval of the committee has, however, been mainly platonic, for, so far as I know, no government have substituted the English system for their own method of periodical valuation by commissions of experts.

In approving the English system of valuation by importers' and exporters' declaration, the committee expressed their desire that some international agreement should regulate this system, and the necessary check which should be exercised over it by officials' examination of the values.

As regards the basis of valuation most European countries adopt the practice of valuing imports as they lie in the port of arrival, *i. e.*, including cost of freight; and exports at their value at the port of export, *i. e.*, excluding cost of freight. The United States, however, present an exception to this practice as regards imports, which are valued according to

the invoice values declared by the importers at the port of shipment, *i. e.*, excluding the cost of freight.

In my report to the Institute, at their Vienna meeting, I referred at some length to an endeavor which was being made by the British Government to secure uniformity of practice in the trade statistics of the various portions of the British Empire. I showed that, as regards valuation of goods, the practice of nearly half the British Colonies was defective in that only the value at the port whence the goods were shipped was shown for the imports.

This practice in many of the Colonies was closely bound up with the payment of customs duties which were mainly *ad valorem*, based on the invoice values of the goods imported. An attempt is being made to correct these values for statistical purposes by an addition of, or allowance for, the cost of freight, and I would ask the committee to make this suggestion with regard to the United States imports, so as to make their statistics more comparable with those of European countries.

The United States department has lately set a good example to other compilers of trade statistics in endeavoring to secure the proper conversion into gold values of free imports from countries where the currency is depreciated.

Turning to the second point, the origin and destination of imports and exports, it may be observed that the Institute have passed somewhat contradictory resolutions. At their meeting in Paris in 1889 they recognized the serious difficulty of showing the prime origin and ultimate destination of goods, and did not even assert that this information was desirable, while at Vienna the necessity of recording these particulars as fully as possible was distinctly affirmed by resolution. The British Government in their recommendations to the Colonies have adopted a middle course. While recognizing that the port or place from which goods have been last carried may have been only a depot for them, they admit that it is not possible, and would, even if possible, often be misleading to

record the original country where the goods were produced, but they recommend the registration of the country where the goods were purchased, and consequently from which an invoice or through bill of lading would usually be available.

In the United Kingdom Trade Accounts the registration of imports and exports has long been made according to the ship's voyage, with certain exceptions, as there can be more certainty in recording the port at which the goods were put on board than in tracing the first place where the goods originated, or their place of ultimate consumption.

Coming now to the third point, viz., the classification of the articles of import and export, it will be remembered that the committee at our last meeting at Vienna were only partially satisfied with the classification which the British Government proposed to adopt for the abstract figures of trade in the various parts of the empire. This classification attempted to settle the vexed question of distinguishing between raw materials and manufactures by treating all half made materials imported for further manufacture as raw materials, while similar articles, such as yarns, pig-iron, etc., produced in the country, were treated as *manufactures* on exportation, because they had employed industrial effort in the country.

The resolution which was adopted by the committee, while recognizing the value of this distinction for industrial purposes, affirmed that it was incomplete for the purpose of international comparison, and we are therefore again called upon to consider the question.

It must be admitted, to begin with, that all classifications are more or less faulty and misleading. For instance, Dr. Von Mayr, who took a very active and intelligent part in the discussion at Vienna, proposed to distinguish as goods manufactured those on which no more labor need be bestowed to fit them for consumption. Such a definition would exclude all textiles destined to be made up into clothing. Dr. Von Mayr made also a pertinent criticism on the class "articles

of food and drink," viz., that many articles, such as beer and spirits and sugar, were included in this heading though they ought to be included under manufactures. Live animals are usually included under articles of food and drink, although even in the case of an animal for food, such as an ox, there is a large proportion of the animal which is not for food at all, being eventually leather or tallow or bone, etc.

Notwithstanding these and many other unavoidable faults in any system, so much pressure is put upon statisticians to classify imports and exports, and to attempt to distinguish materials from manufactures, that most countries now endeavor to show at least the totals of their trade under various headings, and I have appended to this report some tables chiefly extracted from the "Statistical Abstract Relating to Foreign Countries," which give the totals and percentages for a series of years for the chief countries of Europe, and for the United States as regards their special trade.

Russia has four classes: (1) articles of food, including drink and tobacco, which form 20 per cent of her total imports and nearly 60 per cent of the exports; (2) raw and semi-manufactured materials, a large class, which includes about 60 per cent of the total imports and 35 per cent of total exports. Class (3), animals, living, is hardly entitled to be a separate class, representing less than one-half per cent of imports, and only 2 per cent of the exports. Class (4), manufactured articles, has 21 per cent of the imports, but only 4½ per cent of the exports.

The steady decline in the imports and increase in the exports during the last 12 years will be noticed, but the discussion of these changes would travel beyond the scope of this report.

Coming to Germany only three classes are shown. Class (1) consists of food and live animals, which together had 36 per cent of the imports, and 14 per cent of the exports. Since 1880 the imports have increased and the exports decreased considerably, showing the larger dependence of

Germany on foreign food supplies. Class (2), raw materials, shows 42 per cent of the total imports and 22 per cent of the exports. Class (3), manufactured articles, includes various debatable items, such as prepared hides and yarns, and comprises 22 per cent of the imports and as much as 64½ per cent of the exports, the movements having since 1880 been the reverse of those in the food class, namely, a decrease in the percentage of the imports and an increase in the exports, showing great industrial activity.

As regards France, the classification is, like that of Germany, one of three classes, food, raw materials, and manufactures. Horses are, however, classed as raw material instead of under articles of food and live animals, as in Germany.

Class (1) has 35 per cent of the imports and 23 per cent of the exports. Class (2), raw materials, comprises 51 per cent of the imports and 23 per cent of the exports. Class (3), manufactured articles, including, as in the case of Germany, many half-made goods, has 15 per cent of the imports and 54 per cent of the exports.

Turning next to Switzerland there are the three classes of food, raw materials, and manufactured articles. Horses and draught animals generally are among raw materials, and raw tobacco also, while manufactured tobacco is among manufactured articles instead of being classed among food. The imports are divided almost exactly between the three classes, the exports being in articles of food, to the amount of 12 per cent, raw materials also 12 per cent, and the remainder in manufactured articles, 76 per cent, which is a very large proportion.

Turning next to Italy we find four classes of articles, namely: (1) articles of food, (2) raw materials used in industry, (3) worked-up materials used in industry, and (4) manufactured articles. In class (1) the percentage of imports has increased from 20 per cent to 24 per cent, while the exports have declined from 37 per cent to 29 per cent.

Raw materials have increased in imports from 30 per cent to 36 per cent, and in exports from 17 per cent to 20 per cent, while worked-up materials are slightly less in the imports, and in the exports are more, namely, 35½ per cent instead of 31½ per cent in 1881. Manufactured articles show a large decrease in the proportion under imports, viz., from 32 per cent to 24 per cent, with an increase in the exports, which were 16 per cent in 1890 compared with 14 per cent in 1881.

It has not been possible to enumerate the chief articles in the various classes in Italy, so the treatment of such doubtful articles as horses, tobacco, and seeds cannot be stated.

Taking Austria next we find three divisions: (1) articles of food (raw and unprepared); (2) raw materials; and (3) manufactured articles. It will be noticed that manufactured food and tobacco are included among manufactured articles and not among food, and that yarns are also counted as manufactures. These differences of classification will therefore affect the percentages. Raw food imports have declined from 22 per cent of the total to 15½ per cent, while exports have slightly increased from 21 per cent to nearly 23 per cent. Raw materials imported are 39 per cent instead of 30½ per cent, and their exports 27 per cent instead of 24 per cent. The large class of manufactured articles has slightly declined in the imports, being in 1890 nearly 46 per cent, while the exports show a larger decrease, viz., from 55 per cent of the total exports to less than 50 per cent.

We now come to the United States, where we find a totally distinct classification from any of the European ones, and it is further complicated by the import classes differing entirely from those used in the export accounts.

As regards imports there are five classes, namely: (1) articles of food and live animals; (2) articles in a crude condition for use in domestic industry; (3) articles wholly or partially manufactured for use as materials; (4) manufactured articles ready for consumption; and (5) articles of voluntary use, luxuries, etc. This last class includes manu-

factured tobacco, beer, spirits, and wine, and, among textiles, articles of lace, embroidery, or insertion, which are all considered to bear the stamp of luxury. The distinction is, however, one of much difficulty. The proportion of class (1), food and live animals, to the total imports is now nearly 37 per cent, compared with 30½ per cent in 1883, and class (2), crude materials, has also increased, while articles partially or wholly manufactured both for use or consumption have decreased, as also have so-called luxuries, since the passing of the McKinley Act.

As regards the exports, there are six classes, namely: (1) products of agriculture; (2) products of mines; (3) products of the forest; (4) products of the fisheries; (5) products miscellaneous; all these categories consisting of merchandise other than manufactures; and (6) domestic manufactures. Of these, class (1) represents nearly 79 per cent of the total exports, and class (6), domestic manufactures, nearly 16 per cent, leaving only five per cent for the remaining four classes.

It will be remembered that bullion and specie are excluded from all these classifications that we have been considering; an omission of considerable importance as regards the United States.

Having now briefly considered the various classifications of the principal foreign countries I will again refer to the new classification which the British Government have recommended for adoption in the various parts of the British Empire. Up to the present time British India and most of the Crown Colonies have adopted the proposed classification. The Dominion of Canada and the Australasian Colonies have not yet come to a decision, but the former already possesses a classification somewhat akin to that of the United States.

For British India I append a statement of the imports and exports in 1891 and 1892, compiled according to the prescribed system. In 1892, Class (1), live animals, food

and drink, and narcotics, has 11 per cent of the imports and 40 per cent of the exports. Class (2), raw materials, has 10 per cent of the imports and 33 per cent of the exports. Class (3), manufactured articles, has nearly 60 per cent of the imports and 20 per cent of the exports, while the remaining class, bullion and specie, a class which is omitted in the foreign classification which we have been considering, has 20 per cent of the imports and nearly 7 per cent of the exports.

Lastly, I append a statement of the same classification applied to the imports and exports of the United Kingdom in 1892. Here class (1), live animals, food and drink, and narcotics, amounts to 42 per cent of the general imports and to only 7 per cent of the general exports. Class (2), raw materials, has 38½ per cent of the imports and 21 per cent of the exports. Class (3), manufactured articles, has 12 per cent of the imports and 63 per cent of the exports, and the new class of coin and bullion has 7 per cent and 9 per cent, respectively. It will be noticed that both general and special exports are given, and there are considerable differences in the percentages according as one or the other is taken, arising mainly from the large re-export trade of the United Kingdom in food and raw materials. Exports of British manufactures represent no less than 76 per cent of British exports, the exact figure recorded in Switzerland under the same class. The new method of classing half wrought materials among raw materials, when imported, also affects the figures. In the classification which has hitherto been used in the Monthly Accounts of United Kingdom, imported manufactures amounted to 65 millions sterling in 1892, while under the new system the omission of various half-manufactured articles, such as leather, yarns, etc., reduces this amount to 56½ millions.

Having now concluded my survey of the various classifications, I would point out that even in their present divergent forms they present most interesting material for examining the industrial and commercial capacities of the various coun-

tries. I have carefully abstained from commenting on the causes of the results shown by these figures as being a matter outside the scope of the committee, but it will be evident that in combination with statistics, which are every year becoming more reliable, of agricultural and industrial production in the different countries, these trade figures, under an assimilated classification and system of valuation, will add immensely to our knowledge of the resources and intercourse of the various portions of the civilized world.

I. RUSSIAN EMPIRE.

VALUE OF IMPORTS AND EXPORTS (*Special Trade*) INTO AND FROM THE RUSSIAN EMPIRE, DISTINGUISHING ARTICLES OF FOOD, RAW AND SEMI-MANUFACTURED MATERIALS, ANIMALS, AND MANUFACTURED ARTICLES IN EACH YEAR FROM 1880 TO 1891, INCLUSIVE.

	Years.	IMPORTS.		EXPORTS.	
		Value.	Per Cent of Total Value.	Value.	Per Cent of Total Value.
		1,000 *Credit Roubles.*	*Per Cent.*	1,000 *Credit Roubles.*	*Per Cent.*
ARTICLES OF FOOD: (Includes Grain, Potatoes, Rice, Fruit and Vegetables fresh and preserved, Salt Fish, chiefly Herrings, Coffee, Butter, Colonial Wares, Tobacco and Manufactures thereof, Tea, Alcoholic Beverages, etc.) . . .	1880	167,909	27.0	247,886	49.7
	1881	124,633	24.1	261,015	51.6
	1882	147,769	26.1	350,631	56.7
	1883	150,859	26.8	384,685	60.1
	1884	159,212	29.7	347,877	59.0
	1885	117,460	27.0	334,552	62.1
	1886	120,863	28.3	274,702	56.3
	1887	90,633	22.7	373,287	59.9
	1888	78,186	20.2	502,312	63.3
	1889	82,948	19.2	432,581	56.5
	1890	81,764	20.1	393,610	55.8
	1891	77,736	20.9	423,637	58.7
RAW AND SEMI-MANUFACTURED MATERIALS: (Includes Timber, Seeds of all kinds and their extracts, Vegetable Fibres, Furs, Skins; Silk Raw, Cocoons, Waste and Yarn; Wool Raw, Waste and Yarn; Bristles, Metals other than Precious Metals, etc.) . .	1880	289,705	46.5	223,024	44.7
	1881	278,458	53.8	219,457	43.3
	1882	288,265	50.9	232,232	37.6
	1883	297,132	52.9	222,717	34.8
	1884	272,172	50.7	212,478	36.0
	1885	233,367	53.6	172,586	32.1
	1886	226,640	53.2	180,937	37.0
	1887	242,660	60.7	213,686	34.3
	1888	238,858	61.9	246,840	31.1
	1889	265,645	61.5	288,132	37.6
	1890	245,487	60.4	272,358	38.6
	1891	214,089	57.6	248,414	34.4
ANIMALS, LIVING:* (Includes Horses, Cattle, Sheep and Lambs, Swine (including Boars and Sucking Pigs), also Live Geese and other Domestic Birds, etc.)	1880	1,040	.2	16,002	3.2
	1881	1,021	.2	12,706	2.5
	1882	917	.2	19,110	3.1
	1883	1,242	.2	16,482	2.6
	1884	1,058	.2	14,236	2.4
	1885	1,488	.3	14,643	2.7
	1886	1,321	.3	11,767	2.4
	1887	1,185	.3	12,500	2.0
	1888	1,539	.4	13,438	1.7
	1889	1,497	.3	13,269	1.7
	1890	1,689	.4	11,161	1.6
	1891	1,607	.4	16,720	2.3
MANUFACTURED ARTICLES:† (Includes Manufactures of China and Glass, Bricks, Earthen Ware and Pottery, Metals, Machinery, Furniture, Boots and Shoes, Paper, Gutta-percha, Leather Wares, Linen, Hemp, Wool, Silk, and Cotton Manufactures, Beds and Bedding, Wearing Apparel, Watchmakers' Goods, Candles, Books, Pictures, etc.) . . .	1880	164,158	26.3	11,760	2.4
	1881	113,601	21.9	13,245	2.6
	1882	129,841	23.0	15,823	2.6
	1883	112,999	20.1	16,411	2.5
	1884	104,494	19.4	15,310	2.6
	1885	83,073	19.1	16,871	3.1
	1886	77,687	18.2	21,077	4.3
	1887	65,149	16.3	23,479	3.8
	1888	67,559	17.5	31,274	3.9
	1889	81,881	19.0	32,020	4.2
	1890	77,710	19.1	27,968	4.0
	1891	78,088	21.0	32,166	4.5
TOTAL	1880	622,812	....	498,672	....
	1881	517,713	....	506,423	....
	1882	566,792	....	617,796	....
	1883	562,232	....	640,295	....
	1884	536,936	....	589,901	....
	1885	435,388	....	538,652	....
	1886	426,511	....	488,483	....
	1887	399,627	....	622,952	....
	1888	386,142	....	793,864	....
	1889	431,971	....	766,002	....
	1890	406,650	....	705,097	....
	1891	371,584‡	....	721,613§	....

* Includes also some dead game. † Except certain manufactures which are included under the category of Articles of Food. ‡ Including Imports of the value of 64,000 Roubles, not separately distinguished in any of the respective categories. § Including Exports of the value of 676,000 Roubles, not separately distinguished in any of the respective categories.

II. GERMANY.

VALUE OF IMPORTS AND EXPORTS (*Special Trade*) INTO AND FROM GERMANY DISTINGUISHING ARTICLES OF FOOD, RAW MATERIALS, AND MANUFACTURED ARTICLES IN EACH YEAR FROM 1880 TO 1891, INCLUSIVE.

	Years.	Imports.		Exports.	
		Value.	Per Cent of Total Value.	Value.	Per Cent of Total Value.
		Millions of Marks.	*Per Cent.*	*Millions of Marks.*	*Per Cent.*
ARTICLES OF FOOD AND LIVE ANIMALS: (Includes Horses, Cattle, Sheep, Swine, Goats, Live Fowl, Animal and Farinaceous Substances Raw and Manufactured; Fruits, Vegetables, Spices, Salt, Ice, Colonial Wares, Fermented and Distilled Beverages, Confectionery, Tobacco Raw or Manufactured, etc.)	1880	920	32.6	641	22.1
	1881	982	33.1	591	19.8
	1882	1,049	33.5	664	20.8
	1883	1,060	32.5	686	21.0
	1884	1,044	32.0	614	19.2
	1885	893	30.3	528	18.5
	1886	846	29.3	486	16.3
	1887	967	30.9	500	15.9
	1888	907	27.6	486	15.2
	1889	1,229	30.6	401	12.7
	1890	1,397	33.5	471	14.2
	1891	1,513	36.3	439	13.8
RAW MATERIALS:* (Includes Seeds and Herbs for Sowing, also Fodder, Waste Substances, Manures, Combustibles, Crude Oils and Chemicals, Earths, Stones, Ores, Metals, Timber, Pulp, Raw Hides and Skins, Hair, Feathers, Raw Textile Materials (un-spun), Caoutchouc and Gutta-percha Raw or Cleaned, etc.)	1880	1,118	39.6	584	20.2
	1881	1,150	38.8	633	21.3
	1882	1,211	38.7	643	20.2
	1883	1,282	39.3	623	19.0
	1884	1,300	39.9	578	18.0
	1885	1,211	41 2	532	18.6
	1886	1,193	41.3	555	18.6
	1887	1,325	42.4	586	18.7
	1888	1,507	45.8	646	20.1
	1889	1,793	44.6	667	21.0
	1890	1,784	42.9	710	21.3
	1891	1,753	42.0	688	21.7
MANUFACTURED ARTICLES:† (Includes Manufactured Oils, Chemicals, Earthen Ware, Porcelain, Glass, and Metals, Wood Carvings, Paper and Manufactures thereof, Prepared Hides, Leather, Yarns, Textile Goods, Hosiery, Railway Rolling Stock, Machinery and Instruments, Small Wares, Literary and Artistic Objects, Wearing Apparel, etc.) . .	1880	783	27.8	1,670	57.7
	1881	831	28.1	1,753	58.9
	1882	869	27.8	1,883	59.0
	1883	922	28.2	1,963	60.0
	1884	917	28.1	2,013	62.8
	1885	840	28.5	1,800	62.9
	1886	849	29.4	1,945	65.1
	1887	833	26.7	2,049	65 4
	1888	877	26.6	2,074	64.7
	1889	993	24.8	2,099	66.3
	1890	981	23.6	2,147	64.5
	1891	904	21.7	2,049	64.5
TOTAL	1880	2,821	....	2,895	....
	1881	2,963	....	2,977	....
	1882	3,129	....	3,190	....
	1883	3,264	....	3,272	....
	1884	3,261	....	3,205	....
	1885	2,944	....	2,860	....
	1886	2,888	....	2,986	....
	1887	3,125	....	3,135	....
	1888	3,291	....	3,206	....
	1889	4,015	....	3,167	....
	1890	4,162	....	3,328	....
	1891	4,170	....	3,176	....

* Including certain semi-manufactured articles for use in the Iron and Timber Trades.
† Except certain Manufactures which are included under the category of Articles of Food.

III. FRANCE.

VALUE OF IMPORTS AND EXPORTS (*Special Trade*) INTO AND FROM FRANCE, DISTINGUISHING ARTICLES OF FOOD, RAW MATERIALS, AND MANUFACTURED ARTICLES IN EACH YEAR FROM 1880 TO 1891, INCLUSIVE.

	Years.	IMPORTS.		EXPORTS.	
		Value.	Per Cent of Total Value.	Value.	Per Cent of Total Value.
		1,000 *Francs.*	*Per Cent.*	1,000 *Francs.*	*Per Cent.*
ARTICLES OF FOOD: (Includes Cereals, Coffee, Fruit, Cattle, Meat, Fish, Fats, Cheese, Butter, Sugar, Rice, Vegetables, Cocoa, Olive Oil, Wine, Spirits, and all Distilled and Fermented Beverages, Eggs, Potatoes, Dried Vegetables, etc.)	1880	2,017,300	40.1	834,900	24.1
	1881	1,742,600	35.8	887,300	24.9
	1882	1,670,700	34.6	878,800	24.6
	1883	1,638,200	34.1	849,400	24.6
	1884	1,438,400	33.1	783,400	24.2
	1885	1,455,300	35.6	749,800	24.3
	1886	1,540,700	36.6	731,200	22.5
	1887	1,423,000	35.4	703,000	21.7
	1888	1,507,000	36.7	726,700	22.4
	1889	1,441,200	33.4	837,500	22.6
	1890	1,445,100	32.6	855,400	22.8
	1891	1,652,500	34.7	808,800	22.7
RAW MATERIALS: (Includes Raw Wool, Coal, Silk, Hides, Raw Cotton, Seeds, Wood, Flax, Minerals, Copper, Petroleum, Seed Oils, Lead, Jute, Tobacco in the leaf, Manures, Indigo, Horses, Zinc, Tin, Hemp, Hops, Sulphur, Saffron, Iron and Steel, Cast Iron and Steel, Rags, Builders' Materials, etc.) . . .	1880	2,416,700	48.0	793,100	22.9
	1881	2,437,300	50.1	800,100	22.5
	1882	2,376,000	49.3	807,300	22.6
	1883	2,397,700	49.9	751,600	21.8
	1884	2,208,400	50.9	759,100	23.5
	1885	2,022,800	49.5	707,400	22.9
	1886	2,082,400	49.5	773,000	23.8
	1887	2,014,400	50.0	805,000	24.8
	1888	2,021,200	49.2	813,400	25.0
	1889	2,262,500	52.4	940,600	25.4
	1890	2,341,700	52.8	899,000	23.9
	1891	2,419,400	50.7	834,700	23.4
MANUFACTURED ARTICLES:* (Includes Manufactures of Wool, Silk, Cotton, Hemp, and Flax, Yarns of Cotton, Wool, Flax, and Hemp, Machinery, Metal Wares, Arms, Nitrate of Soda, Soap, Skins prepared, Paper of all sorts, Jewelry, Straw-plait, Leather Wares, Clocks, Tobacco prepared, Small Fancy Wares, Metal Wares, Ready-made Clothing, Glass Ware and Earthen Ware, Chemical and Pharmaceutical Products, Millinery, etc.)	1880	599,200	11.9	1,839,900	53.0
	1881	683,500	14.1	1,874,100	52.6
	1882	775,100	16.1	1,888,300	52.8
	1883	768,400	16.0	1,850,900	53.6
	1884	696,700	16.0	1,690,000	52.3
	1885	610,300	14.9	1,630,900	52.8
	1886	585,000	13.9	1,744,600	53.7
	1887	588,600	14.6	1,738,500	53.5
	1888	578,800	14.1	1,706,600	52.6
	1889	613,100	14.2	1,925,900	52.0
	1890	650,100	14.6	1,999,000	53.3
	1891	695,900	14.6	1,926,200	53.9
TOTAL	1880	5,033,200	....	3,467,900	....
	1881	4,863,400	....	3,561,500	....
	1882	4,821,800	....	3,574,400	....
	1883	4,804,300	....	3,451,900	....
	1884	4,343,500	....	3,232,500	....
	1885	4,088,400	....	3,088,100	....
	1886	4,208,100	....	3,248,800	....
	1887	4,026,000	....	3,246,500	....
	1888	4,107,000	....	3,246,700	....
	1889	4,316,800	....	3,704,000	....
	1890	4,436,900	....	3,753,400	....
	1891	4,767,800	....	3,569,700	....

* Except certain manufactures which are included under the category of Articles of Food.

IV. SWITZERLAND.

VALUE OF IMPORTS AND EXPORTS (*Special Trade*) INTO AND FROM SWITZERLAND, DISTINGUISHING ARTICLES OF FOOD, RAW MATERIALS, AND MANUFACTURED ARTICLES IN EACH YEAR FROM 1885 TO 1891, INCLUSIVE.

	Years.	IMPORTS.		EXPORTS.	
		Value.	Per Cent of Total Value.	Value.	Per Cent of Total Value.
		1,000 *Francs.*	*Per Cent.*	1,000 *Francs.*	*Per Cent.*
ARTICLES OF FOOD: (Includes Chemicals and Drugs to be used as food, Agricultural and Animal Products, Animals not elsewhere mentioned, Food Products, Wine, Spirits, and all Fermented and Distilled Beverages, etc.)	1885	208,968	29.1	79,242	11.8
	1886	225,783	29.1	82,703	12.4
	1887	238,152	28.9	77,019	11.5
	1888	237,995	29.0	72,983	10.8
	1889	262,168	29.0	73,217	10.5
	1890	295,805	31.0	78,822	11.2
	1891	304,159	32.6	80,000	11.9
RAW MATERIALS: (Includes Chemicals and Drugs in a crude state, Dye Stuffs crude, Straw, Manures crude, Wood unwrought, Animals such as Horses, also Farm and Draught Animals, Iron, Lead, Copper, Tin, Zinc, and other Metals, Tobacco in the leaf, Raw Cotton, Hemp, Flax, Raw Silk, Animal Products for Manufacture, etc.)	1885*	263,009	36.7	113,481	17.0
	1886*	292,419	37.7	101,409	15.1
	1887*	317,406	38.6	98,055	14.6
	1888*	308,110	37.5	104,651	15.6
	1889	350,489	38.7	94,363	13.6
	1890	354,792	37.2	85,782	12.2
	1891	322,281	34.6	80,433	12.0
MANUFACTURED ARTICLES:† (Includes Chemicals and Drugs made up, Dye Stuffs manufactured, Glass Wares, Manures, Paper, Wood wrought, Leather Wares, Works of Literature and Art, Earthen Ware, Clocks and Watches, Machines and Machinery, Manufactured articles of Iron, Lead, Copper, Tin, Zinc, etc., Manufactured Tobacco,—Cigars,—Manufactures of Cotton, Linen, Silk, Wool, Guttapercha, Straw, Ready-made Clothing, Animal Products manufactured, etc.)	1885*	245,126	34.2	477,017	71.2
	1886*	257,738	33.2	484,899	72.5
	1887*	267,847	32.5	497,048	73.9
	1888*	275,288	33.5	496,038	73.6
	1889	292,030	32.3	527,943	75.9
	1890	303,676	31.8	538,209	76.6
	1891	305,951	32.8	511,434	76.1
TOTAL	1885*	717,103	....	669,740	....
	1886*	775,940	....	669,011	....
	1887*	823,405	....	672,122	....
	1888*	821,393	....	673,672	....
	1889	904,687	....	695,523	....
	1890	954,273	....	702,813	....
	1891	932,391	....	671,867	....

* Including Bullion and Specie in the years 1885 to 1888 inclusive.
† Except certain manufactures which are included under the category of Articles of Food.

V. ITALY.

VALUE OF IMPORTS AND EXPORTS (*Special Trade*) INTO AND FROM ITALY, DISTINGUISHING ARTICLES OF FOOD, MATERIALS USED IN INDUSTRY, RAW AND WORKED-UP, AND MANUFACTURED ARTICLES IN EACH YEAR FROM 1881 TO 1890, INCLUSIVE.

	Years.	Imports.		Exports.	
		Value.	Per Cent of Total Value.	Value.	Per Cent of Total Value.
		1,000 *Lire.*	*Per Cent.*	1,000 *Lire.*	*Per Cent.*
ARTICLES OF FOOD.	1881	205,139	19.9	356,729	37.5
	1882	205,197	19.5	389,513	40.1
	1883	237,752	20.6	442,941	42.0
	1884	262,322	20.9	387,838	39.0
	1885	209,976	27.9	311,341	33.9
	1886	384,244	25.9	361,381	36.2
	1887	420,083	25.0	415,830	40.3
	1888	274,392	22.7	292,318	30.8
	1889	364,017	26.0	278,915	28.9
	1890	318,811	24.2	255,229	29.1
MATERIALS USED IN INDUSTRY: RAW.	1881	311,084	30.2	163,858	17.2
	1882	327,556	31.1	159,094	16.4
	1883	331,576	28.8	185,179	17.5
	1884	360,746	28.7	176,330	17.7
	1885	394,490	26.8	166,669	18.2
	1886	411,283	27.8	171,849	17.2
	1887	474,027	28.2	159,532	15.5
	1888	398,830	32.9	175,979	18.5
	1889	456,774	32.6	180,225	18.7
	1890	468,624	35.6	171,411	19.6
MATERIALS USED IN INDUSTRY: WORKED-UP.	1881	181,838	17.6	300,439	31.6
	1882	172,002	16.3	287,965	29.6
	1883	197,383	17.1	295,617	28.0
	1884	213,954	17.1	289,579	29.2
	1885	212,680	14.5	291,084	31.7
	1886	232,743	15.7	323,788	32.4
	1887	247,803	14.8	310,105	30.1
	1888	188,932	15.6	348,067	36.7
	1889	220,137	15.7	356,005	36.9
	1890	210,533	16.0	311,321	35.5
MANUFACTURED ARTICLES.	1881	333,759	32.3	130,718	13.7
	1882	349,530	33.1	135,288	13.9
	1883	385,286	33.5	131,649	12.5
	1884	418,440	33.3	139,758	14.1
	1885	452,455	30.8	148,820	16.2
	1886	452,665	30.6	141,962	14.2
	1887	537,579	32.0	146,017	14.1
	1888	348,807	28.8	133,473	14.0
	1889	360,973	35.7	149,965	15.5
	1890	318,618	24.2	137,800	15.8
TOTAL.	1881	1,031,820	....	951,744	....
	1882	1,054,345	....	971,860	....
	1883	1,151,997	....	1,055,386	....
	1884	1,255,462	....	993,505	....
	1885	1,469,601	....	917,914	....
	1886	1,480,935	....	998,980	....
	1887	1,679,492	....	1,031,484	....
	1888	1,210,241	....	949,837	....
	1889	1,401,901	....	965,110	....
	1890	1,316,586	....	875,761	....

NOTE.—The above figures do not agree with those published in the Trade Volumes for the respective years, as those here given have been calculated throughout upon the valuation fixed for 1890. It has not been found possible to enumerate the chief articles included under the various heads.

VI. AUSTRIA.

VALUE OF IMPORTS AND EXPORTS (*Special Trade*) INTO AND FROM AUSTRIA DISTINGUISHING ARTICLES OF FOOD, RAW MATERIALS, AND MANUFACTURED ARTICLES IN EACH YEAR FROM 1880 TO 1890, INCLUSIVE.

	Years.	Imports.		Exports.	
		Value.	Per Cent of Total Value.	Value.	Per Cent of Total Value.
		1,000 *Gulden.*	*Per Cent.*	1,000 *Gulden.*	*Per Cent.*
ARTICLES OF FOOD (RAW AND UNPREPARED): (Includes Cereals, Coffee, Rice, Spices, Colonial Produce, Tea, Tobacco, Raw, etc.) .	1880	134,500	21.9	143,200	21.2
	1881	128,700	20.0	170,400	23.3
	1882	129,400	19.8	207,000	26.5
	1883	115,500	18.5	172,300	23.0
	1884	105,400	17.2	131,500	19.0
	1885	109,000	19.5	133,500	19.9
	1886	88,400	16.4	149,300	21.4
	1887	84,600	14.9	147,600	21.9
	1888	74,600	14.0	169,400	23.3
	1889	81,100	13.8	170,300	22.2
	1890	94,700	15.5	175,800	22.8
RAW MATERIALS: (Includes Cotton, Wool, Flax, Hemp and Jute, Chemical Products, etc.)	1880	187,000	30.5	161,600	23.9
	1881	202,000	31.5	168,900	23.1
	1882	205,000	31.3	174,800	22.3
	1883	213,600	34.2	176,600	23.5
	1884	207,900	33.9	176,200	25.5
	1885	189,700	34.0	170,800	25.4
	1886	200,800	37.2	167,400	23.9
	1887	220,500	38.8	166,100	24.7
	1888	206,100	38.7	186,100	25.5
	1889	226,400	38.4	206,900	27.0
	1890	236,700	38.8	211,700	27.4
MANUFACTURED ARTICLES: (Includes Yarns and Tissues, Manufactures from other Organic Substances, Manufactured Foods, Tobacco Manufactured, Chemical Products, Metals and Metal Wares, Products of minor Manufacturing Industries, Machinery, Instruments, Rolling Stock, Vessels, and other means of transport, Manufactures from Mineral Products other than Metals, etc.)	1880	292,000	47.6	371,200	54.9
	1881	311,100	48.5	392,200	53.6
	1882	319,800	48.9	400,100	51.2
	1883	295,800	47.3	401,000	53.5
	1884	299,300	48.9	383,800	55.5
	1885	259,200	46.5	367,800	54.7
	1886	250,000	46.4	381,900	54.7
	1887	263,500	46.3	359,200	53.4
	1888	252,400	47.3	373,300	51.2
	1889	281,700	47.8	389,000	50.8
	1890	279,300	45.7	383,900	49.8
TOTAL	1880	613,500	....	676,000	....
	1881	641,800	....	731,500	....
	1882	654,200	....	781,900	....
	1883	624,900	....	749,900	....
	1884	612,600	....	691,500	....
	1885	557,900	....	672,100	....
	1886	539,200	....	698,500	....
	1887	568,600	....	672,900	....
	1888	533,100	....	728,800	....
	1889	589,200	....	766,200	....
	1890	510,700	....	771,400	....

VIII. UNITED STATES.

STATEMENT SHOWING THE VALUE OF IMPORTS AND EXPORTS INTO AND FROM THE UNITED STATES, DISTINGUISHED ACCORDING TO THE UNDERMENTIONED CATEGORIES, IN EACH YEAR FROM 1883 TO 1892, INCLUSIVE.

DESCRIPTION OF CATEGORY.	IMPORTS.*									
	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.
	PER CENT OF TOTAL VALUE.									
IMPORTS OF—										
Articles of Food and Live Animals.	30.59	33.66	33.52	31.35	30.92	30.50	32.10	31.92	33.72	36.64
Articles in a crude condition which enter into the various processes of Domestic Industry.	21.29	20.75	20.64	23.31	24.30	24.07	23.96	22.91	23.27	24.67
Articles wholly or partially manufactured for Use as Materials in the Manufactures and Mechanic Arts. .	12.64	12.28	12.46	12.41	11.60	11.73	11.27	10.74	12.91	10.06
Manufactured Articles ready for consumption. . . .	23.17	20.11	20.58	20.14	20.21	20.44	19.61	20.01	16.21	15.97
Articles of Voluntary Use, Luxuries, etc.	12.31	13.20	12.80	12.79	12.97	13.26	13.06	14.42	13.89	12.66

DESCRIPTION OF CATEGORY.	EXPORTS (SPECIAL).									
	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.
	PER CENT OF TOTAL VALUE.									
EXPORTS OF—										
DOMESTIC MERCHANDISE OTHER THAN MANUFACTURES:—										
Products of Agriculture.	77.00	73.98	72.96	72.82	74.41	73.23	72.87	74.51	73.69	78.69
Products of the Mines.	1.30	2.07	2.18	2.05	1.67	2.63	2.73	2.64	2.53	2.04
Products of the Forest.	3.56	3.62	3.03	3.15	3.01	3 51	3.70	3.49	3.29	2.75
Products of the Fisheries.	.78	.77	.82	.77	.73	.82	.97	.88	.71	.53
Products, Miscellaneous.	.67	.75	.76	.71	.73	.76	.74	.61	.41	.38
MANUFACTURES, DOMESTIC.	16.69	18.81	20.25	20.50	19.45	19.05	18.99	17.87	19.37	15.61

* General Imports, except in the Years 1883, 1884, and 1885, where Imports entered for Consumption only are given.

STATEMENT SHOWING THE VALUE OF IMPORTS AND EXPORTS INTO AND FROM THE UNITED STATES, DISTINGUIS

DESCRIPTION OF CATEGORY.	IMPORTS.*										
	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1883.
	VALUE.										
IMPORTS OF—	1,000 Dollars.	1,000 Dollars.	1,000 Dollars.	1,000 Dollars.	1,000 Dollars.	1,000 Dollars.	1,000 Dollars.	1,000 Dollars.	1,000 Dollars.	1,000 Dollars.	1,000 Dollar
ARTICLES OF FOOD AND LIVE ANIMALS: (Includes Coffee, Sugar, Molasses, and Confectionery, Cocoa, crude, and Leaves and Shells of, Breadstuffs, Fish, Fruits and Nuts, Tea, Rice, Spices, also Horses and other Live Animals, etc.)	214,399	224,726	194,266	199,176	213,973	220,786	239,140	251,945	284,716	303,159	619,27
PER CENT OF TOTAL VALUE	30.59	33.66	33.52	31.35	30.92	30.50	32.10	31.92	33.72	36.64	77.0
ARTICLES IN A CRUDE CONDITION WHICH ENTER INTO THE VARIOUS PROCESSES OF DOMESTIC INDUSTRY: (Includes Chemicals, Drugs, Dyes, and Medicines, Coal, Cotton unmanufactured, Flax, Hemp, Jute, and other Vegetable Substances, Furs, and Fur-skins undressed, Hides and Skins other than Fur-skins, India-rubber and Gutta-percha, crude, Lead and Manufactures, Ore, Gold and Silver bearing, Paper Stock—Rags and other, except Wood-pulp—Silk unmanufactured, Tin in Bars, Blocks, or Pigs, Wool unmanufactured, Wood unmanufactured, etc.)	149,166	138,497	119,609	148,146	168,199	174,270	178,646	180,846	196,394	204,094	10,447 1.30 28,630
PER CENT OF TOTAL VALUE	21.29	20.75	20.64	23.31	24.30	24.07	23.96	22.91	23.27	24.67	3.56
ARTICLES WHOLLY OR PARTIALLY MANUFACTURED FOR USE AS MATERIALS IN THE MANUFACTURES AND MECHANIC ARTS: (Includes Cement, Chemicals, Drugs, Dyes, and Medicines, Furs dressed on the Skin and Manufactures, Iron and Steel and Manufactures, Leather and Manufactures, Oils, Paints, and Colors, Wood Manufactures, Materials for Hats, Bonnets, etc.)	88,613	81,961	72,231	78,843	80,329	84,932	83,980	84,747	107,024	83,206	6,276
PER CENT OF TOTAL VALUE	12.64	12.28	12.46	12.41	11.60	11.73	11.27	10.74	12.91	10.06	.78
MANUFACTURED ARTICLES READY FOR CONSUMPTION: (Includes Books, Maps, Engravings, and other Printed Matter, Cotton Manufactures, Earthen, Stone, and Chinaware, Manufactures of Flax, Hemp, Jute, and other Vegetable Substances, Glass and Glassware, Iron and Steel Manufactures, Metals, Metal Compositions and Manufactures, Paper and Manufactures of, Wood, Woollen Wares, Clocks and Watches, Buttons, common, Leather Wares, etc.)	162,409	134,240	119,254	127,975	139,970	147,989	146,081	157,943	138,470	132,179	5,367
PER CENT OF TOTAL VALUE	23.17	20.11	20.58	20.14	20.21	20.44	19.61	20.01	16.21	15.97	.67
ARTICLES OF VOLUNTARY USE, LUXURIES, ETC.: (Includes Cotton, Embroideries, Laces, Insertings, Trimmings, and Lace Window Curtains, Feathers, Flowers, Perfumery, Toys, etc., Flax, Hemp, and Jute Laces, Insertings, etc., Jewelry, Manufactures of Gold and Silver, and Precious Stones, including Diamonds, rough and uncut, Silk Manufactures, Tobacco Manufactures, Wine, Distilled Spirits, Malt Liquors, etc.)	86,243	88,151	74,220	81,296	89,849	95,980	97,285	113,829	118,312	104,764	134,228
PER CENT OF TOTAL VALUE	12.31	13.20	12.80	12.79	12.97	13.26	13.06	14.42	13.89	12.66	16.69
TOTAL—IMPORTS	700,830	667,575	579,580	635,436	692,320	723,957	745,132	789,310	844,916	827,402	804,224

* General Imports, except in the Years 1883, 1884, and 1885, where

UNITED STATES.

DISTINGUISHED ACCORDING TO THE UNDERMENTIONED CATEGORIES, IN EACH YEAR FROM 1883 TO 1892, INCLUSIVE.

892.	EXPORTS (SPECIAL). 1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	DESCRIPTION OF CATEGORY.
	VALUE.										
,000 ollars.	1,000 Dollars.	1,000 Dollars.	1,000 Dollars.	1,000 Dollars.	1,000 Dollars.	1,000 Dollars.	1,000 Dollars.	1,000 Dollars.	1,000 Dollars.	1,000 Dollars.	EXPORTS OF —
3,159	619,270	536,316	530,173	484,955	523,074	500,840	532,141	629,821	642,751	799,328	DOMESTIC MERCHANDISE OTHER THAN MANUFACTURES: — PRODUCTS OF AGRICULTURE: (Includes Cattle and Horses, also Breadstuffs of all Sorts, Cotton unmanufactured, Fruits and Nuts, Oil Cake, Oils, Animal and Vegetable, Provisions — Beef Products, Hog Products, Oleomargarine, Dairy Products — Seeds, Tobacco in the Leaf, Stems, and Trimmings, etc.).
36.64	77.00	73.98	72.96	72.82	74.41	73.23	72.87	74.51	73.69	78.69	PER CENT OF TOTAL VALUE.
	10,447	15,022	15,798	13,654	11,759	17,994	19,948	22,298	22,055	20,693	PRODUCTS OF THE MINES, INCLUDING CRUDE MINERAL OILS: (Includes Coal, Anthracite and Bitumen, Copper Ore, Mineral Oil, crude, Quicksilver, etc.).
	1.30	2.07	2.18	2.05	1.67	2.63	2.73	2.64	2.53	2.04	PER CENT OF TOTAL VALUE.
4,094	28,636	26,223	22,015	20,962	21,126	23,991	26,997	29,473	28,716	27,957	PRODUCTS OF THE FOREST: (Includes Timber, Lumber, etc., also Rosin, Turpentine, and Spirits of Turpentine, etc.).
24.67	3.56	3.62	3.03	3.15	3.01	3.51	3.70	3.49	3.29	2.75	PER CENT OF TOTAL VALUE.
3,206	6,276	5,614	5,955	5,139	5,156	5,519	7,106	7,458	6,209	5,404	PRODUCTS OF THE FISHERIES: (Includes Fish of all kinds, Fish Oils, Spermaceti, Spermaceti Wax, Whalebone, etc.).
10.06	.78	.77	.82	.77	.73	.82	.97	.88	.71	.53	PER CENT OF TOTAL VALUE.
2,179	5,367	5,417	5,555	4,713	5,173	5,218	5,415	5,142	3,612	3,839	PRODUCTS, MISCELLANEOUS: (Includes Furs and Fur-skins, Ice, etc.).
5.97	.67	.75	.76	.71	.73	.76	.74	.61	.41	.38	PER CENT OF TOTAL VALUE.
,764	134,228	136,373	147,187	136,542	136,735	130,300	138,676	151,102	168,927	158,511	MANUFACTURES, DOMESTIC: (Includes Agricultural Implements, Books, Maps, and Engravings, Carriages and Cars and parts thereof, Chemicals, Drugs, Dyes, Medicines, Clocks and Watches and parts of, Copper and Manufactures, Manufactures of Cotton, of Flax, Hemp, and Jute, of India-rubber and Gutta-percha, Fertilizers, Scientific Instruments and Apparatus, Iron and Steel and Manufactures, Jewelry and Manufactures of Gold and Silver, Leather and Manufactures, Musical Instruments, Mineral Oils, refined, Paper and Manufactures, Paraffin, Soap, Spirits, Tobacco manufactured, Wood Manufactures, etc.).
2.66	16.69	18.81	20.25	20.50	19.45	19.05	18.99	17.87	19.37	15.61	PER CENT OF TOTAL VALUE.
,402	804,224	724,965	726,683	665,965	703,023	683,862	730,283	845,294	872,270	1,015,732	TOTAL — EXPORTS OF DOMESTIC PRODUCE AND MANUFACTURE.

d 1885, where Imports entered for Consumption only are given.

IX. BRITISH INDIA.

VALUE OF IMPORTS AND EXPORTS (*excluding Government transactions*) INTO AND FROM BRITISH INDIA, DISTINGUISHING ARTICLES OF FOOD, ETC., RAW MATERIALS, MANUFACTURED ARTICLES, ETC., IN THE YEARS 1891 AND 1892 (*Calendar Years*).

(*Including Bullion and Specie.*)

	Imports.				Exports.			
	Value.		Per Cent of Total Value.		Value.		Per Cent of Total Value.	
	1891.	1892.	1891.	1892.	1891.	1892.	1891.	1892.
	Rupees.	*Rupees.*	*Per Cent.*	*Per Cent.*	*Rupees.*	*Rupees.*	*Per Cent.*	*Per Cent.*
LIVE ANIMALS, FOOD AND DRINK, AND NARCOTICS:								
(*a*) Live Animals . . .	3,307,388	3,034,109	.4	.4	999,809	1,316,983	.1	.1
(*b*) Food and Drink . .	83,995,139	79,116,171	10.2	10.0	346,881,359	338,340,984	33.2	31.2
(*c*) Narcotics (Opium and Tobacco)	1,529,139	1,804,492	.2	.2	94,715,344	97,663,431	9.1	9.0
LIVE ANIMALS, ETC. - TOTAL	88,831,666	83,954,772	10.8	10.6	442,596,512	437,321,398	42.4	40.3
RAW MATERIALS:								
(*a*) Textile	52,705,961*	43,261,938*	6.4	5.5	216,984,035	200,012,727	20.8	18.4
(*b*) Metal	9,866,462	7,664,381	1.2	1.0	129,733	85,729	less than .1	less than .1
(*c*) Other (including Chemicals and Drugs) .	24,122,879	28,607,060	2.9	3.6	174,085,815	160,270,560	16.7	14.8
RAW MATERIALS - TOTAL	86,695,302	79,533,379	10.5	10.1	391,199,583	360,369,016	37.5	33.2
MANUFACTURED ARTICLES:								
(*a*) Textile	305,798,528	288,722,770	37.2	36.7	100,565,119*	111,628,156*	9.6	10.3
(*b*) Metal	47,056,385	58,443,817	5.7	7.4	622,635†	670,994†	.1	.1
(*c*) Other‡	144,105,441	119,730,050	17.5	15.2	84,340,862	101,115,476	8.0	9.3
MANUFACTURED ARTICLES TOTAL	496,960,354	466,896,637	60.4	59.3	185,528,616	213,414,626	17.7	19.7
TOTAL	672,487,322	630,384,788	81.7	80.0	1,019,324,711	1,011,105,040	97.6	93.2
COIN AND BULLION:								
(*a*) Gold	53,259,344	14,867,339	6.5	1.9	11,607,353	49,434,493	1.1	4.5
(*b*) Silver	96,700,679	142,405,212	11.8	18.1	13,345,082	24,957,622	1.3	2.3
COIN AND BULLION - TOTAL	149,960,023	157,272,551	18.3	20.0	24,952,435	74,392,115	2.4	6.8
TOTAL (INCLUDING COIN AND BULLION)	822,447,345	787,657,339	....	....	1,044,277,146	1,085,497,155	....	.. .

* In the case of Imports, Twist and Yarn are included under Raw Materials, but in Exports under Manufactured Articles.

† Includes Hardware and Cutlery.

‡ Includes Machinery, Railway Materials, Dyes, and Oils in the case of Imports. In the Exports, Dyes and Oils only are specially mentioned as being included.

X. UNITED KINGDOM.

VALUE OF IMPORTS AND EXPORTS INTO AND FROM THE UNITED KINGDOM, DISTINGUISHING ARTICLES OF FOOD, ETC., RAW MATERIALS, MANUFACTURED ARTICLES, ETC., IN THE YEAR 1892.

(Including Bullion and Specie.)

	Imports (General).		Exports (General).		Exports (Special).	
	Value.	Per Cent of Total Value.	Value.	Per Cent of Total Value.	Value.	Per Cent of Total Value.
	1,000*l.*	*Per Cent.*	1,000*l.*	*Per Cent.*	1,000*l.*	*Per Cent.*
Live Animals, Food, and Drink, and Narcotics .	191,713	42.0	23,560	7.3	10,444	4.1
Raw Materials:						
(*a*) Textile	81,198	17.8	26,604	8.3	1,783	.7
(*b*) Metal	21,557	4.7	4,006	1.3	333	.1
(*c*) Other kinds	72,799	16.0	35,638	11.1	19,111	7.5
Raw Materials - Total	175,554	38.5	66,248	20.7	21,227	8.3
Manufactured Articles:						
(*a*) Textile	26,025	5.7	110,860	34.6	108,238	42.3
(*b*) Metal	4,848	1.1	38,861	12.1	38,189	14.9
(*c*) Other kinds	25,654	5.6	52,111	16.3	48,979	19.1
Manufactured Articles Total	56,527	12.4	201,832	63.0	195,406	76.3
TOTAL	423,794	92.9	291,640	91.0	227,077	88.7
Coin and Bullion:						
(*a*) Gold	21,583	4.7	14,832	4.6	14,832	5.8
(*b*) Silver	10,746	2.4	14,079	4.4	14,079	5.5
Coin and Bullion - Total	32,329	7.1	28,911	9.0	28,911	11.3
TOTAL (including Coin and Bullion)	456,123	....	320,551	....	255,988	....

Synopsis.]

THE GEOGRAPHICAL DISTRIBUTION OF THE POPULATION OF THE UNITED STATES.

By Henry Gannett,
Of the United States Geological Survey.

The original settlements within the territory now constituting the United States were made mainly along the Atlantic coast. As the people increased and multiplied they spread inland to the westward, following in the main parallels of latitude. The northwestern states have been peopled, so far as their inhabitants of native origin are concerned, from the northeastern states, and similarly the southwestern states have been peopled from the southeastern states. There has been little movement of population from north to south or the reverse.

The importation of negro slaves from the West Indies, and from Africa, began at a very early date in colonial history. The slave population was never of importance in the northern states, but in the southern states it early became a very large element, so large and so well adapted to the climatic conditions as to practically monopolize the labor of that part of the country. It constitutes now about one-eighth of the total population.

The social position which the colored element occupies in the south is in the north filled by the foreign element. Immigration from Europe to this country was never of great importance until 1847, when the famines in Ireland and political troubles in Germany produced an overflow from these countries into this. Since then immigration has continued in enormous and rapidly increasing volume, until up to the present time more than fifteen and one-half million people have crossed the Atlantic and found homes in this country. Most of these people are from northern Europe, from Ireland, Great Britain, Germany, and Scandinavia. In recent years

the Russians, Poles, Bohemians, and Italians have joined the throng in considerable numbers.

Nearly all these immigrants land in New York, and thence scatter over the northern part of the country, being drawn hither or thither by considerations of climate or occupation. In the northeastern states they have to a certain extent supplanted the native stock. Of all these foreigners the British are scattered the most widely over the north. The Irish are found mainly in southern New England and New York; the French Canadians almost entirely in New England, while the Germans have spread to the westward; and the Scandinavians are found in Wisconsin, Minnesota, and the Dakotas, where they have located as far north as possible without going beyond our jurisdiction. Summing up the habitat of the foreign element, we may say that it is found wherever the negro is not found, that is, throughout the north and west, while the negro is found only in the south. It results from this that in classifying these two elements of the population in accordance with the elements of climate they are found to be in the highest degree complementary. The foreign-born element constitutes about one-seventh of the total population.

A study of the environment of the population, and of these elements, is of interest, since climate and elevation have doubtless exerted a considerable influence, either directly or indirectly, in bringing about the present distribution.

The broader features of the distribution of population are as follows: that the great body of the inhabitants are found in the eastern part of the country and in middle latitudes, and, of course, in that part of the country which is drained to the Atlantic Ocean. Moreover, that nearly half the population of the country is located in the drainage basin of the Mississippi River.

The great body of the inhabitants live at low altitudes above the sea, nine-tenths being found at a less elevation than 1500 feet, and three-fourths of them below 1000 feet.

As to temperature, the great body of the population live where the mean annual temperature is between 45 and 55 degrees, and as to rainfall, the majority live where its mean annual amount is between 30 and 50 inches.

Considering the two elements, the foreign born and the colored, the former are found in northern latitudes and the latter in southern latitudes. While both elements are found at low altitudes, the colored seek the low coast regions, and avoid high altitudes in a much greater degree than the foreign born do. As to temperature, the foreign born are found under much colder conditions than the colored, the latter seeking a hot climate, while the former are found under colder conditions than the average of the total population. The case is similar, though in a less degree, in regard to rainfall, the colored seeking regions of great rainfall, while the foreign born are found where the rainfall is very much less.

The habitat of the people as regards elevation, temperature, and rainfall is summed up in the following table, showing the average elevation, average mean annual temperature, and average mean annual rainfall under which the total population, the foreign born, and the colored elements were living in 1890.

	Total Population.	Foreign Born.	Colored.
Average elevation (feet)	788	890	427
Mean annual temperature (degrees Farenheit)	53	48	61
Mean annual rainfall (inches)	41.4	37.7	50.9

A PRELIMINARY REPORT ON ANTHROPOMETRY IN THE UNITED STATES.

By Edward Mussey Hartwell, Ph.D., M.D.,
Director of Physical Training in Public Schools of Boston, Massachusetts.

The writer has adopted the above title for this paper since his chief purpose, at this time, is to call attention to the number and variety of the publications which relate to anthropometry in the United States, without attempting a complete or critical analysis of any of them. It is also proper to note that the appended Provisional List includes several titles of books and articles which have been published in Europe by American writers, and a few titles of articles relating to anthropometry in America by European writers.

In this paper the term anthropometry is used in the sense originally attributed to it by Quetelet, which includes the measure of the different faculties of the human being; although anthropometrical study in the United States has been pursued, for the most part, for the sake of determining the physical proportions of the body and its parts.

Considered as a whole, the American literature on anthropometry consists largely of descriptive and tabulated reports of the results reached by individual observers in comparatively narrow and disconnected fields of investigation. A very considerable amount of material has been amassed, but much of it is so heterogeneous as to remind one of a heap of nuggets of crude ores of different kinds, which, to yield true metal, must needs be sorted, roasted, and refined. Nevertheless, in spite of some vagueness of aim and considerable diversity of methods, a sufficient amount of valuable material has been published in relation to the growth and development of children and adolescents to warrant an earnest and laborious attempt to sift, collate, and recast it in such wise as to make it available for the purposes of the vital statistician,

the biologist, the psycho-physicist, and even the routine educationist. It is clearly the part of wisdom to utilize the material at present in hand, partly in order that its actual value may be ascertained, and partly because a comprehensive and searching study of it would serve to indicate what problems should be attacked next, and to suggest the most hopeful means of attack in such problems.

That the study of anthropometrical problems has become more extensive and diversified recently is rendered evident by comparing the number and variety of the titles of works published since 1880, or even since 1890, with those published between 1850 and 1880. (See appended Provisional List.) It is noteworthy, moreover, that interest in the physiological and psycho-physical bearings of anthropometrical science is steadily increasing. [See the articles by Bolton (7), Bryan (12), Burnham (13), Gilbert (15), Porter (22), Scripture (26), and West (31) cited below].

As regards amount of statistical data and the discussion of theoretical questions, the weightiest contributions to anthropometrical science in America have been made in the department of Military Anthropometry by Messrs. Elliott (55), Gould (57), and Baxter (52). Next in rank, in the order named, are the departments of Anthropometry of School Children (see Bowditch, 8, 9, and 10; Peckham, 20 and 21; Porter, 22–25; and Boas, 5 and 6); and the Anthropometry of Students (see Hitchcock, 91–102; Sargent, 106–109; Enebuske, 88 and 89; and Wood, 113–117). The papers of Beyer (53), Enebuske (88 and 89), and Porter (22) give evidence of a growing tendency to attempt to correlate the results of anthropometrical investigations, and the teachings of physiology as to the development of functional power. In the field of criticism and discussion of methods the articles of Boas (34), Gulick (38), and Porter (47) mark a new and hopeful departure. Minot's paper (45) is a valuable contribution to the theory of growth. Spiess, of Frankfurt am Main, and Geissler and Ulitzsch, in Saxony, measured large

numbers of school children, in respect to height, in order to determine the normal dimensions of desks and seats to be used in school by the children in question. It would appear that no investigations of this sort, worthy of mention, have been made as yet in this country.

Dr. Bowditch's papers are of capital importance, by reason of the light they throw on the law of growth, and the significance of the physical changes incident to puberty. Their bearing upon school management has not been sufficiently recognized as yet by school authorities in this country. Dr. Bowditch is now generally credited with being the first to show that boys and girls have different rates of growth, as regards height and weight; and his observations and conclusions have been strikingly corroborated by Peckham, Porter, and West in the United States, and by the investigations of a Royal Commission in Denmark, by Roberts in England, Pagliani in Italy, Erismann in Russia, Geissler and Ulitzsch in Saxony, and by Axel Key in Sweden.

The writer, who is at present engaged in making a comparative study of mortality and growth rates, finds that there is a striking relation between the death rates of Boston boys and girls and their respective rates of growth, as determined by Bowditch. That is to say, the death rates of Boston boys are lowest during the period of their most rapid growth, and the death rates of Boston girls are lowest during their period of most rapid growth. He also finds that a similar relation exists between the death and growth rates of Swedish boys and girls. The results of the writer's investigations touching this question will be published shortly in the *Quarterly Publications of the American Statistical Association.*

The use of anthropometry as a means for guiding and testing procedures in physical training is becoming general in the leading colleges for men and women, and in a few secondary and special schools, and in the Y. M. C. A. Herein is found one of the most characteristic developments of anthropometry in America. In this connection, special mention

should be made of the life size "anthropometric statues" exhibited by Dr. Sargent in the Anthropological Department of the Columbian Exposition, since they constitute a unique and highly interesting contribution to anthropometry. They are intended to represent the bodily proportions and conformation of the typical college man and college woman, and are based on extensive unpublished data belonging to Dr. Sargent. The Bertillon anthropometrical system, for the identification of criminals, has been adopted by a few penal institutions. Extensive anthropometrical investigations have recently been made upon American Indians under the supervision of Dr. Franz Boas. The results of Dr. Boas's studies remain to be published. The amount of undigested and unpublished material in military, prison, school, and college anthropometry is now very extensive, and increases yearly.

Hitherto American anthropometrists, as a rule, have worked too much apart from one another, along short lines, and within comparatively narrow limits. It is time to attempt to bring about a closer organization, one that shall conduce to unity of purpose and intelligent coöperation in the field of investigation, and to the adoption of the most approved scientific methods of recording, collating, and publishing the results of such investigations. Such an organization should also seek to keep heartily and thoroughly in touch with the anthropometrists of Europe. It is to be hoped that the recent establishment of special committees on anthropometry by the International Statistical Institute, and of the American Statistical Association, respectively, will tend to promote a more vigorous and intelligent prosecution of anthropometrical studies on both sides of the Atlantic.

PROVISIONAL LIST OF WORKS —ARTICLES, BOOKS, AND TABLES — RELATING TO ANTHROPOMETRY IN THE UNITED STATES, INCLUDING 117 TITLES, ARRANGED IN CLASSES I–VI.

Class I, Nos. 1–3, titles relating to Art.
Class II, Nos. 4–33, titles relating to Anthropometry of Children.
Class III, Nos. 34–51, titles relating to Methods in Anthropometry.
Class IV, Nos. 52–58, titles relating to Military and Naval Anthropometry.
Class V, Nos. 59–85, titles relating to Miscellaneous Topics in Anthropometry.
Class VI, Nos. 86–117, titles relating to Anthropometry of Students.

ANALYSIS OF TITLES ACCORDING TO DATE OF PUBLICATION AND CLASS OF SUBJECT.

	1. Art.	2. Children.	3. Methods.	4. Military.	5. Miscellaneous.	6. Students.	Total.
Period 1850-60	0	0	0	1	2	0	3
Period 1860-70	1	0	0	2	4	1	8
Period 1870-80	1	3	0	1	2	0	7
Period 1880-90	1	8	8	1	8	10	36
Period 1890-94	0	19	10	2	11	21	63
Sum	3	30	18	7	27	32	117

CLASS I. TITLES RELATING TO ART.

1. ALLEN, H. *An Analysis of the Life-Form in Art.* Philadelphia, 1875. 4to.
2. FLETCHER, R. *Human Proportion in Art and Anthropometry.* A lecture delivered at the National Museum, Washington, D. C. Cambridge, 1883. M. King. 37 p. 4 pl. 8vo.
3. STORY, W. W. *The Proportions of the Human Figure, According to a New Canon, for Practical Use: with a Critical Notice of the Canon of Polycletus, and of the Principal Ancient and Modern Systems.* London, 1866. 8vo.

CLASS II. TITLES RELATING TO ANTHROPOMETRY OF CHILDREN.

4. ABBOTT, S. W. *The Evidence of Still-Birth.* Transactions of Massachusetts Medico-Legal Society. I. 56. Boston, 1879. Relates to length and weight of infants at birth.

5. BOAS, F. *Anthropological Investigations in Schools.* Pedagogical Seminary, Worcester, Mass., 1891. I. 225–228. Also in *Science*, New York, 1891. Vol. xvii, 351–352.

6. ——*The Growth of Children.* Science. New York, 1892. Vol. xix, 256; 281–282; xx, 351–352.

7. BOLTON, T. L. *The Growth of Memory in School Children.* American Journal of Psychology. 1892. Vol. iv, 189–192; 362–380.

8. BOWDITCH, H. P. *The Growth of Children.* Report of Board of Health of Massachusetts. Boston, 1877. Vol. viii. 51 p., 10 tables.

9. ——*The Growth of Children: a Supplementary Investigation, with Suggestions in Regard to Methods of Research.* Report of Board of Health of Massachusetts. Boston, 1879. Vol. x. 33–62. 11 pl.

10. ——*The Growth of Children. Studied by Galton's Method of Percentile Grades.* Report of Board of Health of Massachusetts, 1889–90. Boston, 1891. Vol. xxii. 479–522.

11. ——*The Relation between Growth and Disease.* Reprinted from Transactions of the American Medical Association. Philadelphia, 1881. 9 p.

12. BRYAN, W. L. *On the Development of Voluntary Motor Ability.* American Journal of Psychology. Worcester, 1892. Vol. v. 125–204. 3 charts.

13. BURNHAM, WM. H. *A Scheme of Classification for Child-Study.* Pedagogical Seminary. Worcester, Mass., 1893. Vol. ii. 191–198.

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REMARKS ON THE THEORY OF ANTHROPOMETRY.

By Franz Boas, Ph.D.

The theory of anthropometric statistics is based largely upon Quetelet's investigations, who endeavored to prove that the distribution of anthropometric data follows the law of chance. Some attempts to develop the theory further have been made by Stieda and Ihering and by Francis Galton. The former emphasized the introduction of the average variation of measurements into the consideration of the subject, the latter developed what has become known as the method of percentile grades. Stieda was also the first to express a doubt as to the general applicability of the law of chance.

The anthropometric characteristics of a group of people are treated in various ways. Some authors consider the average of the measurements the most valuable result; others prefer to compute the mean value, which is, more properly speaking, the probable value, as it is computed as that value above and below which fifty per cent of the whole series are found; still others compute the most frequent value. The followers of Francis Galton compute the mean value and the points representing various percentile grades, *i. e.*, points below which ten per cent, twenty per cent, thirty per cent, and so forth, of the total series are found. Anthropologists who study the physical characteristics of races use mostly the method of seriation. They give the percentage of cases of the series which fall between certain limits. Still another method which is frequently applied consists in the comparison of those percentages of the series which lie above or below a certain limit.

We will examine the merits of these methods. Whenever

the distribution of measurements follows the laws of chance the average may be considered the type represented by the series. In this case the average, the probable value, and the most frequent value will be identical, provided the series of observations is sufficiently large. In practice they will naturally always show slight differences. In these cases the average must be used, not the probable or the most frequent value, because the first named can be determined with greater accuracy than the others. When a limited number of observations are given, and the mean error of the average, of the probable value, and of the most frequent value are computed, it is found that the mean error of the average is smaller than that of the probable value; the mean error of the latter is, in turn, smaller than that of the most frequent value. For this reason the probable value, or, as it is often called, the mean value, or the fifty percentile grade, must not be used for the purpose of describing the type of a series of measurements which are distributed according to the laws of chance.

When the distribution of cases does not correspond to the laws of chance, neither the average, nor the probable value, nor the most frequent value can be utilized without a previous theoretical treatment of the curve representing the laws of distribution. Based on Quetelet's statements, it has generally been assumed that all anthropometric measurements are distributed according to the laws of chance, and that the curves will approach the theoretical curve the more closely the greater the number of cases that is embodied in the series. I believe that Stieda was the first to intimate that deviations from the law may occur, although he does not follow out this suggestion. A. and J. Bertillon have proved that such deviations occur. Later on, Bowditch has shown that the curves showing the distribution of statures and weights of children do not follow the laws of chance. He shows this by pointing out the fact that during the period of growth a constant difference exists between the average and probable

values. Galton also paid some attention to this subject, and Dr. Gulick mentioned it in a recent paper. Glancing over the curves representing large series of measurements, it strikes me that they conform to the laws of chance only in a general way, and that considerable deviations are quite frequent. It is necessary to consider the biological laws underlying the phenomena under consideration. Assuming that there is a uniform ancestral type in a certain district, and that the conditions of life remain stable, we may expect that the people representing its offspring will be grouped around the type according to the laws of chance. Assuming, however, that there were two distinct ancestral types in adjoining districts, and that these types intermingled, we cannot foretell what the distribution of forms among the offspring will be. It may be that they represent an intermediate type between the parental forms. In this case we might expect to find them distributed according to the laws of chance. But it may also be that we find them to have a tendency to reproduce one or the other ancestral type, either pure or slightly modified. In this case the resulting curve would not conform to the laws of chance, and would show an entirely different character. There is considerable evidence that the laws of inheritance are such that there exists a tendency of reproducing ancestral traits, not of producing new intermediate traits. Therefore, we may be prepared to find considerable deviations from the laws of chance. It is clear that, if intermixture does not result in producing an intermediate type, an attempt to express the type by means of an average of the existing forms will have no meaning whatever. The probable value would have just as little meaning. If the two parental forms were entirely distinct and reproduced without change, the most frequent values might have a meaning, as the two forms would occur most frequently. This, however, would depend upon many conditions favorable to such a result; the proportion of the two elements would have to be nearly equal, their difference

great, and each form must have a limited amount of variability only. A concrete case of this kind is found in the anthropometry of the half-blood race of Indian and white parentage. Generally speaking, the ancestry of a people will be such that a number of forms which do not differ very much among themselves enter into its composition. The greater the number of forms, the nearer the curve of measurements will conform to a probability curve; but, nevertheless, it must be borne in mind that the mixture may be such that constant deviations from such a curve are found which are not due to accident. Our conclusion from these considerations is that anthropometric measurements do not, as a rule, follow the laws of chance, and that a careful examination of the curves is necessary in each case. We cannot expect that in all cases a classification of the material will lead to curves which follow the laws of chance more closely, as the laws of heredity are such that they do not necessitate an arrangement of this character. These facts must make us very careful in the use of the average considered as the type of a series. It will be necessary to investigate each series in order to ascertain if there are any deviations from the law of chance which seem to be due to constant causes, not to accident.

Besides these biological considerations, we must consider a number of other factors which may cause deviations from the probability curve. If a series of measurements is distributed according to the laws of chance, and the measurements of the whole series are changing, deviations will occur whenever the rate of change is not uniform. Such changes occur during the period of growth, and this is the cause of the asymmetry of distribution of measurements of children to which Dr. Bowditch called attention. Similar changes may occur when the conditions of life of a community are changing, or when one form is gaining preponderance over another form. In all such cases the computation of the average, of the mean, and of the most frequent value have no

meaning. The cause and character of the asymmetry of the curve must be determined, and a mathematical treatment must be applied which takes the asymmetry into consideration. It is not necessary to elaborate the theory of treatment of such curves, as the treatment depends upon the character of the asymmetry. It will be sufficient to say that during a period of acceleration in the increase of the measurement the average will always be too great as compared to the typical value for the period under consideration, while for a period of retardation in the increase of the measurement the reverse is the case. For this reason the values for average statures at a certain age which have been computed so often have no biological value as typical statures for the respective age.

I believe I have shown that we must exercise great care in the application of the method of averages, particularly that we cannot assume the average to be the type of a series without a careful scrutiny of its character.

This is still more true if we consider correlations of measurements. It is generally assumed that when a group of measurements of a series of individuals is taken the combination of the average of the measurements will represent the typical individual. Dr. Sargent's statues of the typical American are based on this assumption. The first objection to this assumption is based on the well-known fact that, if a variable is given and a function of the same, then the average of the function is not identical with the function of the average of the variable.

Furthermore, the general distribution of the measurement may apparently correspond to the law of chance, although a number of distinct types are represented in the series whose presence may be revealed by a classification of the whole series. For example: If the measurements of the Indians around the Great Lakes were tabulated without a subdivision into tribes, it would be found that their length of head and breadth of head are distributed according to the laws of

chance. The average length of head would be 193 mm., the average breadth of head 155 mm. According to the method under consideration, this would be the typical combination. When the tribes are properly subdivided in an eastern and a western group, it will be found that the length of head is 195 mm. in the west, 191 in the east, and that 193 does not represent the type of any one tribe. These people speak the same language, and might be gathered on one reservation. In that case a subdivision would be impossible, and an erroneous result would be obtained. Therefore, a critical study of distributions must precede the establishment of the type. The theory of statistics points to a clear way for this study, but unfortunately it has never been applied up to this time. The study must be based on a comparison of the variabilities of measurements. Whenever the variability of a measurement that is correlated to another one is abnormally increased we must suppose that there is an intermixture of types.

I must add a few words regarding the subject of correlations.

The admirable investigations of Mr. Alphonse Bertillon and those of Sören-Hansen, Bischoff, and others have proved that with increasing height all other measurements increase not proportionally, but at a slower rate. This law may be given a wider meaning by saying that whenever a group of people are arranged according to one measurement, with the increase of this measurement all others increase at a slower rate, the rate being the slower the slighter the correlation. This law leads us to establish the fact that we must consider each measurement as a function of a number of variable factors which represent the laws of heredity and environment. The correlation of two measurements will be close when they depend largely upon the same factor, slight when they depend largely upon distinct factors. This difference in the degree of correlation, which is a well-established fact, proves that the system which is applied in many of our

gymnasia is faulty. If the teacher of the gymnasium is given a pupil whose stature is, for instance, such that twenty per cent of all the individuals of his age are taller than he, then it is his ideal to train the pupil to that point that all his other measurements come up to the same standard. If all the men who have this particular stature were plotted alone, it would be seen at once that their measurements would be quite different from this assumed standard. This fundamental objection has already been raised by Dr. L. Gulick.

This assumption is one of the developments of the method of percentile grades. While this method has certain advantages in bringing home to the untrained public some of the valuable results to be gained from anthropometric inquiries, it is highly objectionable for theoretical studies. It does not explain any fact that cannot be explained just as well and with the tenth part of labor and with greater satisfaction by the method of mean variations, and whenever it has been applied it has proved to be misleading in so far as it suggests always that a certain percentile grade represents certain groups of individuals. For instance, during the period of growth, the average eighty per cent child has been assumed to represent, "on the average," the same child, which is most assuredly not the case. This method ought, therefore, to be applied with much greater care and for much more limited purposes than has been done heretofore.

I hope my remarks have served to point out some of the directions in which the theory of anthropometric statistics needs further treatment, and what defects remain to be remedied. I have in my full paper given a number of examples and elaborated the theories and methods which here I could indicate only with a few words.

ON THE APPLICATION TO INDIVIDUAL SCHOOL CHILDREN OF THE MEAN VALUES DERIVED FROM ANTHROPOLOGICAL MEASUREMENTS BY THE GENERALIZING METHOD.

By W. Townsend Porter, M.D.,

Assistant Professor of Physiology in the Harvard Medical School.

I.

The method employed by Quetelet in his anthropometrical studies of the phenomena of human growth was based on two fundamental propositions, (1) the mean of a great number of individuals of the same class is the typus or norm of the class; and (2) the deviations of individuals from the typus follow the law of accidental causes, and are subject to the calculus of probabilitjes.

From these propositions it results that the typus in any dimension, *e. g.*, height, at any age in the period of growth, is the mean of a sufficiently large number of observations of that dimension at the given age, and that the degree with which the observed approaches the true mean can be determined by an application of the principle of least squares.

When the means of any one dimension, for example, height at each age in the period of growth, are compared, the law of growth in that dimension is at once apparent, and may be expressed graphically in a curve whose abscissæ are years, and whose ordinates are centimetres, kilogrammes, or other units of measurement. Not only is the mean at any age thus fixed, but the probability of any given deviation from that mean is fixed as well. Thus the mean height of 2192 St. Louis Public School girls,* aged 8, is 118.36 cm., with a probable error of

* W. Townsend Porter, "The Physical Basis of Precocity and Dullness," *Transactions of the Academy of Science of St. Louis*, Vol. VI, No. 7, March 21, 1893, pp. 161-181. Also "Untersuchungen der Schulkinder in Bezug auf die physischen Grundlagen ihrer geistigen Entwickelung," read before the Berliner Gesellschaft fur Anthropologie, Ethnologie, und Urgeschichte, July 15, 1893, and published in Virchow's *Zeitschrift fur Ethnologie.*

0.079 cm., and a probable deviation of 3.7 cm. This being known, it follows that of the 50 per cent of those who exceed the mean

25	per cent	should	fall	between	118.36	cm.	and	122.06	cm.
16.2	"	"	"	"	122.06	"	"	125.76	"
6.7	"	"	"	"	125.76	"	"	129.46	"
1.8	"	"	"	"	129.46	"	"	133.26	"

and 0.3 should exceed 133.26 cm., while the remaining 50 per cent should deviate from the mean in a precisely similar manner, but in an opposite direction.

The method admits of still another application. It is evident that in the series just given 122.06 cm. is the height of a girl who is taller than 75 per cent of the girls of her age, and not so tall as the remaining 25 per cent. Her position is thus definitely fixed with relation to the mean. She is in fact the typus or mean of the 50 per cent who exceed the mean of the whole number. The height of such an individual at any age would equal $M+d$, where M is the mean height of the age, and d the probable deviation. The values of $M+d$ determined for each age in the period of growth are comparable, and reveal the growth of the typus of the 50 per cent who exceed the mean of the whole number at each age. The growth of the typus of the 50 per cent who fall below the mean height can be similarly made plain, and, by continuing the process, the law of growth at any given deviation from the mean can be determined.

The data for these studies can be collected either by the "generalizing" or "individualizing" plan. In the former, a great number of measurements is made but once on individuals of different ages, and the measurements classified according to age. In the latter, the same individuals are measured yearly, or oftener, during their period of growth, and the measurements classified also by age. The generalizing method is rapidly and easily carried out, whereas the individualizing method demands for its execution exceptional opportunities and exceptional patience, requiring not only

that the measurements be made and the records kept through two decades, but that the number of children measured in the early years of this long period be very great, lest death and desertion so thin their ranks that those remaining to the end shall be too few to yield reliable conclusions. Both methods, when applied to the same material, give identical results with regard to means, including those of subdivisions as well as those of the whole number of observations at any age. The individualizing method does more.

The importance of the individualizing method has been much emphasized, for the reason that it can give information without which the laws derived from means cannot, in the present state of knowledge, be applied to individuals. Before this application can be made it is necessary to know the degree of probability that an individual who at a given age stands at a certain deviation from the mean of any dimension will show the same deviation at other ages; for example, the degree of probability that a girl whose height at age 8 is 122.06 cm., and who therefore deviates 3.7 cm., or $+d$ from the mean (118.36 cm.) of her age, will deviate to the same degree ($+d$) from the mean height throughout her growth. In that case the law of growth for the typus at a deviation of $+d$ from the mean is her law of growth. Otherwise she is an exception, and practical regulations deduced from the law for the typus cannot be safely made binding on her. This knowledge, as has just been said, is furnished by the individualizing method, while the generalizing method is of no assistance in this matter.

The application to individuals of the law of growth of the mean is a subject of immediate practical interest. The connection between theory and practical affairs is here unusually short and clear. Were this application possible, the deviations of children from the laws of normal growth could be quickly recognized, and by timely treatment largely overcome, the evil effects of over-study could be watched and intelligently combated, and systems of education, no longer

exacting from all that which should be exacted only from the mean, could be rationally adapted to the special needs of the exceptionally weak and the exceptionally strong. These beneficent reforms, it is at present believed, must await the slow collection of data by the individualizing method. If it is indeed true that the laws of growth determined for the mean cannot be used for the individual until the individualizing method has established the probability of each individual deviation remaining constant throughout the period of growth, then a generation must elapse — so slow is the gathering of data by this method — before the necessary knowledge is in our hands. I hope to show that this long waiting is unnecessary, and that the data collected by the generalizing method may be used, in a way hitherto unrecognized, for the making of standards by which the deviation of an individual from the mean of his age can be seen to be normal or abnormal.

Let the problem be clearly understood. The question is: This boy or girl is above or below the mean height, or weight, etc. of his or her age,— how shall it be known that this deviation is normal or abnormal? There has been hitherto no satisfactory reply to this question. A vague and partial answer is possible after two measurements separated by at least a year's interval. If the deviation is the same, or very nearly the same, at both measurements, the probability is that the child is growing normally. This probability is greater than the general probability that a normal deviation is more likely to occur than an abnormal one, but its numerical value is wholly unknown. If, on the other hand, the two deviations are unequal, the probability is that the greater of them is abnormal, but the numerical value is here also unknown. How definitely the individualizing method could answer this question is difficult of conjecture, in the present lack of data, but certainly no answer whatever could be expected until after two measurements separated by a year's interval,— a year in which the unchecked cause of an abnormal deviation

might inflict irreparable damage on the organism. Such indefinite and fragmentary knowledge can never be the basis of a practical reform. Any solution of this problem which shall gain general acceptance must be easy to understand and easy to apply, and must give the probable degree of abnormality of any observed deviation. These conditions are, I believe, fulfilled by the following method.

According to the theory of probabilities the heights of a thousand individuals of the same class will arrange themselves as follows: —

[Where M = the mean, and d = the probable deviation]

$+n\,d$	3
$+4\,d$	18
$+3\,d$	67
$+2\,d$	162
$+\ d$	250
M	
$-\ d$	250
$-2\,d$	162
$-3\,d$	67
$-4\,d$	18
$-n\,d$	3

Let these be divided into seven groups: —

I.	All	individuals	between	$+n\,d$	and	$3\,d$	21
II.	"	"	"	$+3\,d$	"	$2\,d$	67
III.	"	"	"	$+2\,d$	"	$+\ d$	162
IV.	"	"	"	M	"	$+\ d$	500
V.	"	"	"	$-\ d$	"	$-2\,d$	162
VI.	"	"	"	$-2\,d$	"	$-3\,d$	67
VII.	"	"	"	$-3\,d$	"	$-n\,d$	21

The mean height, weight, girth of chest, etc. of each of these groups at any given age will be the typus of a certain degree of deviation from the mean of the age, — that is to say, the heights, weights, etc. of each group will be symmetrically distributed above and below the mean height, weight, etc. of the group in the manner already illustrated for the entire undivided number of observations, *i. e.*, the entire

thousand. Each group, therefore, will be characterized by a physical development definitely determined by the means of height, weight, and other physical dimensions. These means taken together form the typus or norm of the group. The individual deviations from this norm follow the theory of probability, and the degree of abnormality presented by any individual deviation can be expressed in the terms of this theory. An example will illustrate this: A boy x shows a deviation in height of $+1,5\ d$ from the mean height of his age; he falls therefore in group III. The boys in this group possess a mean weight of M^1 kilog., with a probable deviation of $+d^1$, that is, boys from d to $2\ d$ taller than the norm of their age should weigh M^1+d^1 kilog. In like manner they should possess a girth of chest of M^2+d^2 centimetres, and a span of arms of M^3+d^3 cm., and so on. If the weight, etc. of the boy x coincide with the means of his group (group III) his physique is normal, the accuracy of this conclusion being proportionate to the number of different measurements on which it is based. If the boy x deviate more than $\pm d$ from the mean in one or more dimensions his development is abnormal, and the degree of abnormality is measured by the amount of his deviation.

The necessity of choosing some one dimension as a basis of such a system of measurement is self-evident. There are good reasons, partly theoretical and partly practical, why height rather than weight should be taken as a basis. Height is more stable, less liable to irrelevant fluctuations than weight. An excess in weight can be reduced; a child whose weight is out of proportion to its height may be brought into proportion by suitable diet and exercise; but height once attained cannot be reduced, nor can the growth in height be easily influenced. Practically, therefore, the physical trainer must be content to bring the weight, girth of chest, strength of squeeze, and other physical dimensions up to the mean development which corresponds to the height of the child. Experience has abundantly shown that the relation of weight

to height is of great importance to health, life insurance companies declining to receive applicants whose weight falls much below the standard weight of their height. For these reasons height should be preferred as the basis of the system.

The question whether any given deviation is normal or abnormal is answered by this system in two ways: in respect of height, by the degree of deviation from the mean or norm of the whole number of observations; in respect of other dimensions, by the degree of deviation of the weight, girth of chest, etc. from the mean weight or girth of chest corresponding to the height of the individual under examination, this normal weight, etc. being determined with sufficient exactness by taking the means and probable deviations of the group in which the height falls. It is evident that all cases included within $M \pm d$ must be termed normal, for the chances are even that any individual measurement in a series will fall within $M \pm d$, and are against its exceeding these limits, being 4.64 against 1 that it will fall at $M \pm 2\,d$.

Strictly speaking, all abnormal deviations in any dimension are probably unhealthful, yet an important difference exists in this respect between abnormal deviations in height and abnormal deviations in weight, girth of chest, etc. as related to height. It cannot be doubted that abnormal height is probably (using the word in its technical sense) a disadvantage. The potential energy of the body is converted into mechanical labor and heat, by far the greater expenditure taking the latter form. In the adult the total expenditure in the form of heat is about 2700 calories in 24 hours (Helmholtz), of which 80.1 per cent escape in radiation, conduction, and evaporation from the skin. Thus the superficies of the body plays a great part in the dissipation of energy. The superficies is greater usually in tall children than in short, a difference of special importance in the young, in whom metabolism is much more active than in the adult. More heat is therefore lost by the abnormally tall than by those of normal height. There is a disadvantage also in the loss by mechan-

ical labor. Greater height entails increased work on the heart and on the skeletal muscles. In short, increased loss of energy goes hand in hand with increase in height. Hence in the tall the necessity of a physical development which shall be so much above the mean as to compensate their greater loss of energy. In growing children not only must there be compensation for the expenditure of energy, but there must be energy stored in the increase of tissue which constitutes growth.

If the greater demands of tall children are balanced by a correspondingly greater income of energy, a normal equilibrium or "health" is preserved. It should be clearly recognized that this equilibrium is unaffected by the absolute height, and is dependent only on the relation between height and the other physical dimensions. Consequently, health is as possible in tall children as in those of normal height, although less probable, for the chances against a compensatory development of weight and other dimensions increase very rapidly with the deviation of the height from the norm. The absolute height of an individual is, therefore, of very secondary interest from a practical point of view, because it is not necessarily a state of ill health, whereas the development of weight, girth of chest, etc. in proportion to height is of supreme interest. The lack of proportion between height and other physical dimensions is itself ill health. The tendency of organisms to adapt ends to means is strong, and an imperfect compensation may suffice for most demands. A heart in which an hypertrophy of the left ventricle has partially compensated an insufficiency of the mitral valve may beat regularly enough for ordinary exertions, and yet fail utterly when its possessor is forced to suddenly ascend a height, or to make any other unusual exertion. So a tall child may have a sufficient income of energy to meet the demands of a wisely regulated life, and sink under the burden of unusual tasks.

It has been shown in the foregoing pages that the means derived from anthropometrical measurements by the generalizing method can be used to determine whether the weight and other physical dimensions of an individual are normal in relation to height, and it has been pointed out that this normal relation constitutes the health of the individual. It follows that the normal amount of labor cannot be exacted without injury from those in whom this normal equilibrium is wanting. These facts must therefore be taken into account in a rational school system, and it should now be made plain how this is to be done.

II.

All systems of education have for their object the largest possible development of individual minds. In large schools the tasks by which this development is promoted are those which secure from the child of mean ability its maximum mental output. In practice they are determined by examinations. Hence the existence in every educational institution of classes or grades based on the mental output of the mean pupil, and related to age only in that the output fixed as the standard of any class is necessarily found more often at a certain age than at other ages. Thus there exists a mean age for each class, the greater number of pupils at any age being found in the same class, while some have advanced beyond, and others, equally old, have not yet come so far as this class.

On an average, those who have advanced beyond the greater number of their age are precocious, that is, possess more than the mean capacity for mental labor, while those who are less advanced are dull, possessing less than the mean capacity. It has been demonstrated that there is a physical basis for precocity and dullness.* When numbers sufficiently large for safe statistical work are employed, it is seen that precocious pupils possess a greater mean weight, height, etc. than the mean pupils, and that the latter are heavier and

* W. Townsend Porter, *loc. cit.*

taller than the dull. The mental output is therefore directly related to the physical condition of the pupils. The mean height, weight, girth of chest, etc. in any grade is the mean physical development corresponding to the mental output of the grade. It follows that those who do not possess this development cannot, without abnormal strain, do the work exacted in this grade. On the other hand, pupils who possess more than the mean physical development of their age should be capable of more than the mean labor. Yet the management of this latter class presents but few difficulties, whereas the former class cannot be too carefully protected.

The consequences of continued overstrain in a growing boy or girl are most unhappy. The curves of growth in height and weight of the mean child are characteristic. The quick rise to age 7 or 8, the slower ascent to age 11 in girls and 13 in boys, the remarkable three years of accelerated development preceding puberty, and, finally, the rapid decrease in the rate of growth as full development approaches express the normal development of the type, and, presumably, the normal development of the individual. Overwork may cause a temporary or a permanent deviation in these curves. It is probable, though not certain, that a temporary loss, consequent on a slight overstrain, may not lower the final outcome of the development, but there can be no doubt as to the result of a prolonged strain. In such a case, the probability is strong that the whole subsequent curve will be turned out of its course. A prolonged strain in a growing child harms for life, and leaves a mark which can never be effaced. The danger is greatest in the periods of quickest development, particularly great in the prepubertal period. It is a sufficient commentary on the evils of the present educational methods that during these very years the indiscriminating routine of a system devised for the average pupil is most inflexibly applied to weak and strong alike.

Overstrain can often be recognized both by subjective and objective symptoms. Subjective symptoms, however, are

frequently obtained with difficulty, especially in pupils who are unusually ambitious, and who over-study from choice. An objective symptom is therefore necessary,—a symptom easily demonstrated and almost never wanting. Such a symptom is the failure to gain weight at the normal rate. A persistent loss of weight in an adult is regarded as a matter of grave concern; the persistent failure of a child to make the normal gain in weight is no less grave. It is not pretended that the failure to gain weight always accompanies overstrain, but it is claimed that the number of exceptions is small, and that frequent weighing is the most practical and, in the whole, the most certain method of detecting the presence of influences that are working injury to the development of the child. The skillful breeder of cattle depends on systematic weighing to inform him whether his efforts to secure well-developed animals are meeting with success, but children are left to grow at hap-hazard.

It is not enough that overstrain should be recognized by the harm it has done. The child should be guarded against the possibility of harm. The anthropometrical system proposed in this article offers a means of doing this. It infallibly discovers those whose physical development is below the standard of their age. It no less certainly indicates the physical development which most often accompanies the power to do the mental work of any grade. It therefore divides the pupils into two bodies, those physically competent and those physically incompetent for a clearly defined degree of mental exertion. When working with great numbers, the infallibility of this system is practically absolute and theoretically almost absolute. When applied to individuals, errors will certainly occur, but the number of errors will, according to the laws of probability, be less than the number of correct conclusions. And these errors cannot influence the great fact that such a system is competent to call attention to the children who shall probably be unable to do the normal work of their age without injury. Each individual case must then be treated on its own merits.

The proposed system of physical examination requires —

I. The collection of sufficiently extensive data by the generalizing method.

II. The determination of the means and the probable deviations of height, weight, girth of chest, strength of squeeze, etc. for each age.

III. The division of the individuals at each age into groups in terms of the probable deviation from the mean height, as illustrated above, and the calculation of the mean and probable deviation of the weight, girth of chest, etc. of each group.

IV. The determination of the mean physical development of the pupils in each class or grade of the school system.

V. The physical examination of each applicant for entrance to any grade.

These data permit the enforcement of the following regulation: No pupil whose physical development deviates more than $\pm d$ from the weight, etc. of the mean pupil of his height in a class which his mental output would otherwise entitle him to enter shall be admitted to that class unless with the approval of a medical expert, if possible a regularly appointed school physician, who shall testify that the pupil's strength shall be equal to the strain.

ANTHROPOMETRIC STATISTICS OF AMHERST COLLEGE.

By Edward Hitchcock, M.D.

When the Department of Hygiene and Physical Education was established in Amherst College, about thirty years ago, one of the very first things accomplished was the securing of bodily measurements and tests of every student as he entered the college, and again at intervals. This has been kept up with increasing accuracy and enlargement, and is still an important feature of the department. It has been the habit of the department to furnish at many of the public occasions of the college, along with the schedule of the exercises, some anthropometric and other closely connected statistical details in a printed form.

The first work to be mentioned is the result of five years' record of the measures of all the students of college, in eight items of inquiry, from 1861 to 1865. These averages were:

Age, 21 years and 4 months.	
Weight, without clothes, . . .	137.9 pounds.
Height, ...	67.8 inches.
Chest girth, without clothes, . .	35.3 "
Arm girth, ...	11.3 "
Forearm girth, ...	10.9 "
Capacity of Lungs, ...	237.2 cubic inches.
Measure of strength, ...	11.3

During the same five years the *sickness of college students* as averaged to each man, and to the four classes, was recorded. In this study each man in college lost 2.34 days of the year from sickness or accident, a man being regarded as "sick" who was absent three or more consecutive days from all college exercises.

The number of individuals who were sick during this period, giving the average of each class, was found to be: —

Seniors, ...	5.6 men.
Juniors, ...	7.0 "
Sophomores, ...	10.8 "
Freshmen, ...	12.8 "

showing that health increased during the college course.

Some items were gathered in a study of ten years, by classes, with reference to sickness, as before mentioned, and the results were as follows: —

Seniors,	averaging	50.0	men,	had	6.6	on	the	sick	list.
Juniors,	"	53.2	"	"	9.1	"	"	"	"
Sophomores,	"	62.9	"	"	12.6	"	"	"	"
Freshmen,	"	64.1	"	"	14.9	"	"	"	"

And in this same period the average loss of time to each sick man was 11.4 days, and to all the college of 2.1 days. There also were among these men 43 different maladies, of which 33 per cent were colds and 9 per cent physical accidents and injuries.

Still later, statistics of 14 years' duration for 3488 students were compiled, and the following law seemed to be deducible: The rate of difference in numbers between freshmen and sophomores was 6 per cent, and the decrease in sickness 15 per cent. Between the sophomore and junior classes the numerical difference was 14 per cent, and the decrease in sickness 17 per cent. The falling off in numbers from junior to senior years was 8 per cent, and the sickness decreased to the amount of 30 per cent.

A study of the viability of the first 39 classes of the college —1821 to 1860 — on the living condition of these graduates has also been a matter of study. The average viability was 84 per cent, or 16 per cent mortality in classes, averaging at their graduation 24 years of age.

Another study during 1874 was (see *Table A*, p. 590) —

Table A.

Some of the Anatomical and Physiological "Constants" of a student of Amherst College. Determined by 4311 observations recorded during the past thirteen years, with the relative percentage of the different classes, the Freshman as the unit of comparison.

	Age in Years.	Relative per Cent.	Weight in Pounds.	Relative per Cent.	Height in Feet.	Relative per Cent.	Chest Girth in Inches.	Relative per Cent.	Arm Measure in Inches.	Relative per Cent.	Forearm Measure in Inches.	Relative per Cent.	Utmost Lung Capacity in Cubic Inches.	Relative per Cent.	Test of Strength.	Relative per Cent.	Relative Class Percentage.
Seniors.....	22.403	1.164	142.239	1.067	5.681	1.016	35.755	1.014	11.716	1.033	11.141	1.020	259.610	1.093	11.427	1.201	1.076
Juniors.....	21.941	1.140	141.552	1.062	5.682	1.016	36.006	1.022	11.676	1.029	11.060	1.013	254.341	1.071	11.411	1.200	1.069
Sophomores....	20.700	1.075	138.395	1.038	5.663	1.013	36.107	1.025	11.638	1.025	11.062	1.013	256.222	1.099	10.700	1.125	1.051
Freshmen.....	19.248	1.000	133.331	1.000	5.590	1.000	35.236	1.000	11.351	1.000	10.920	1.000	237.445	1.000	9.512	1.000	1.000
All.....	21.073	1.095	138.879	1.042	5.654	1.011	35.776	1.015	11.595	1.021	11.045	1.011	251.904	1.061	10.512	1.105	1.049

In 1879 the average and mean measurements of 1262 students, attending between 1861 and 1878, were contrasted in respect to six items. The contrasts are here shown. The average age was 21 years and three months.

	Mean.	Average.
Weight in pounds,	127	139
Height in inches,	67	66
Chest girth in inches,	36	36
Arm " " "	11	12
Lung capacity in cubic inches,	220	250
Pull up, number of times,	12	11

26,060 measures of 1321 students of the six items below gave strength to the belief that the body gains its physical perfection between 26 and 30 years of age.

It is generally accepted as a law that bodily growth continues until the age of 30. This law, however, is not verified by these statistics when studied by the single years of observation, owing probably to an insufficient number of data, and specially above the age of 24. But on grouping the years thus: All under 20; all from 20 to 24, inclusive; and all from 25 to 29, inclusive, there is a very close illustration of the general law, as is seen by this table.

Age.	Weight.	Height.	Chest Girth.	Arm Girth.	Lung Capacity.	Body Lift.
Under 20	133.50	66.20	34.75	11.33	233.85	9.88
20 to 24	140.28	68.12	36.25	11.78	254.23	10.68
25 to 29	143.40	68.48	36.85	11.69	264.66	10.64

See *Table B* on page 592.

After 20 years of gathering and recording anthropometric statistics of our students several tables were compiled relating to physical measures, growth and development, the sick list, and the maladies. These are here inserted.

See *Table C* on page 593.

Table B.

The average results of the measures of the weight, height, chest, arm, lung capacity, and body lift of 1321 different students of Amherst College during the years 1861–62 to 1877–78, inclusive.

Age in Years.	Number.	Weight in Pounds.	Number.	Height in Inches.	Number.	Chest in Inches.	Number.	Arm in Inches.	Number.	Lung Capacity in Cubic Inches.	Number.	Times Lifted.	Total Numbers.
17	42	131.821	42	66.156	42	33.847	42	11.131	42	220.27	40	8.47	250
18	573	133.250	573	66.596	573	35.019	573	11.353	551	237.31	571	10.35	3,414
19	751	135.440	751	67.068	751	35.397	751	11.514	715	243.96	751	10.83	4,470
20	759	138.106	759	67.800	759	35.723	759	11.584	726	249.52	757	10.54	4,519
21	722	139.529	722	67.716	722	35.748	722	11.828	697	249.93	721	10.73	4,306
22	523	140.852	523	68.148	523	36.109	523	11.819	496	253.65	520	10.98	3,108
23	382	140.680	382	68.260	382	36.330	382	11.901	360	256.83	380	10.73	2,268
24	258	142.249	258	68.676	258	37.365	258	11.794	247	261.22	256	10.44	1,535
25	144	145.029	144	68.832	144	36.025	144	11.777	140	264.15	143	10.01	859
26	106	144.261	106	68.436	106	38.528	106	11.780	96	262.63	104	10.50	624
27	57	143.911	57	68.316	57	36.923	57	11.851	54	266.20	56	10.53	338
28	27	141.129	27	68.664	27	36.374	27	11.574	24	269.79	26	12.31	158
29	19	142.684	19	68.076	19	36.415	19	11.513	19	260.52	15	9.86	110
30	18	146.500	18	69.192	18	36.705	18	11.611	17	279.65	12	7.50	101
	4,381		4,381		4,381		4,381		4,184		4,252		26,060

Table C.— Measures of 2106 different students of Amherst College, showing the Averages of each class for twenty years, in Age, Weight, Height, Chest Girth, Arm Girth, Forearm Girth, Lung Capacity, Body Lift, Finger Reach, Chest Expansion, and the Comparative Right and Left Hand Strength.

	Number Observed.	Age.	Weight.	Height.	Chest Girth.	Arm Girth.	Forearm Girth.	Lung Capacity.	Body Lift.	Finger Reach.	Chest Expansion.	Right Hand Strength.	Left Hand Strength.	Per Cent Strongest with Right Hand.
Seniors.....	1,113	22.24	142.19	67.94	35.97	11.77	11.21	251.05	11.33	69.72	3.18	92.02	86.48	93
Juniors.....	1,148	21.87	140.59	67.86	35.61	11.72	11.07	250.07	11.31	69.78	3.33	88.99	85.98	97
Sophomores....	1,263	20.57	139.39	67.53	35.44	11.69	11.06	249.23	10.58	69.70	3.45	90.45	86.05	96
Freshmen.....	1,489	19.31	133.19	67.33	34.76	11.23	10.80	233.08	8.61	69.60	3.00	87.83	83.34	96
College Average	5,013	21.10	138.84	67.66	35.40	11.19	11.02	241.79	10.25	69.69	3.02	89.69	85.50	95
College Mean..	.....	.....	131.00	67.50	35.50	11.25	. ...	230.00	11.00	.....	.....	.....	.....	....

Table D.— Showing the Maxima and Minima of every measurement of the 2106 students observed.

	Age, Years and Months.	Weight in Pounds.	Height in Inches.	Chest Girth in Inches.	Arm Girth in Inches.	Forearm Girth in Inches.	Lung Capacity in Cubic In.	Body Lift.	Finger Reach in Inches.	Chest Range in Inches.
Maxima.....	35.6	216	76.5	43.00	15.5	15.00	426	65	81.10	5.50
Minima.. ..	15.3	84	58.0	27.25	8.0	8.25	115	2	48.00	1.50

Table E — The *Mean Observations* of the measures of Amherst College students for twenty years, from a total of 34,384.

Weight in Pounds.	Number.	Height in Inches.	Number.	Chest Girth in Inches.	Number.	Arm Girth in Inches.	Number.	Lung Capacity in Cubic Inches.	Number.	No. of Times Body Lifted.	Number.
175	69	72	104	40	61	14.0	44	340	53	21	88
167	105	71	291	39	165	13.5	81	320	94	20	176
159	238	70	385	38	394	13.0	323	300	275	18	372
151	490	69	808	37	704	12.5	602	280	608	16	610
143	798	68	955	36	1,079	12.0	1,117	260	871	14	790
135	1,157	67	986	35	1,164	11.5	1,205	240	1,287	12	940
127	1,198	66	790	34	1,098	11.0	1,245	220	1,275	10	1,075
119	982	65	571	33	682	10.5	658	200	732	8	796
111	487	64	371	32	310	10.0	316	180	379	6	590
103	163	63	208	31	104	9.5	77	160	148	4	302
95	46	62	65	30	41	9.0	17	140	39	2	120
	5,733		5,534		5,812		5,685		5,761		5,859

Table F.— Data of Student Sickness and Physical Disability for nineteen years and nine months in Amherst College.

Students' names on the annual Catalogues, 1861 to 1881, inclusive, 5443.

	Names on An'l Catalogues for 20 Years.	Names on Sick List.	Per Cent of Each Class to Whole College.	Per Cent of Sickness in Each Class to Whole College.
Seniors	1,192	260	21.90	19.05
Juniors	1,270	319	23.33	23.37
Sophomores	1,465	386	26.92	28.28
Freshmen	1,516	400	27.85	29.30
	5,443	1,365	100.00	100.00

Students on the sick list,	1,375
Cases (not individuals) of sickness,	1,725
Cases on sick list more than once in the year,	350
Per cent of college on the sick list,	25.26

Table G.— The Maladies of the students, and their proportion, when it equals one or more per cent of the whole. This is the number of *cases*, not students.

Maladies.	Per Cent.	Maladies.	Per Cent.
Colds, Pneumonia, Bronchitis, etc.	37.4	Liver and bilious	2.3
Physical injury	8.8	Neuralgia	1.8
Febriculæ	4.8	Malaria	1.7
Eyes, weak and sore	4.7	Mumps	1.7
Quinsy and sore throat	4.6	Diphtheritic	1.1
Boils	4.1	Measles	1.1
General inability	3.1	Teeth	1.1
Typhoid fever	3.1	Stomach	1.1
Bowels	2.6	Overwork	1.0

Table H.— The measures of Weight, Height, Chest, Arm Girth, Lung Capacity, and Body Lift of 2106 different students of Amherst College, arranged by age.

Age.	Number of Observations.	Weight.	Height.	Chest.	Arm.	Lung Capacity.	Body Lift.
17	330	131.99	66.60	33.87	11.12	224.8	8.58
18	1,172	134.07	66.96	35.10	11.36	238.7	10.35
19	1,511	135.84	67.30	35.38	11.52	240.3	10.82
20	1,358	138.12	67.95	35.52	11.57	248.8	10.97
21	1,171	140.00	68.01	35.58	11.69	250.1	10.84
22	807	141.07	68.11	35.98	11.77	250.8	10.92
23	559	141.21	68.31	36.29	11.71	257.0	10.63
24	362	142.42	68.44	37.23	11.74	261.0	10.62
25	216	145.12	68.68	36.66	11.79	263.6	10.11
26	141	144.91	68.82	37.46	11.81	262.5	10.71
27	71	144.40	68.30	36.95	11.84	268.4	10.37
28	30	140.71	68.52	36.28	11.57	269.8	8.51
29	19	142.68	68.09	36.41	11.51	260.5	9.86
30	18	146.50	69.19	36.70	11.61	279.5	7.50

Table I.— Giving the measures of 749 students of Amherst College at two intervals of three years and six months, and at an average age of 19 years and two months at the first observation, showing their physical development during this period.

		Per Cent.
Number of *men* measured, ...	749	
" " increased in all items, ...	196	26.15
" " decreased in some items, . . .	401	53.40
" " both same and increased items,	355	47.39
" " both same and decreased items,	211	28.17
Number of *items* secured, ...	5,160	
" " showing increase, ...	3,972	76.97
" " same Freshman and Senior year,	487	9.43
" " less in Senior year, ...	701	13.58

	Weight. Pounds.	Height. Inches.	Chest. Inches.	Arm. Inches.	Forearm. Inches.	Lung Capacity. Cubic in.	Body Lift.
Greatest individual gain...	56.00	6.00	6.50	4.000	3.500	1.34	25.00
Averages of increased men	12.27	1.05	1.45	0.853	0.685	28.40	4.50
Per cent of decreased items	11.00	....	20.31	13.460	25.270	14.64	20.13

Some statistics have been gathered showing the differences between the "average" and the "mean."

Sir John Herschel has said "an average may exist of the most different subjects, as the height of houses in a town, or the size of books in a library. It may be convenient to convey a general notion of things, but it involves no conception of a natural and recognizable central magnitude, all differences from which ought to be regarded as deviations from a standard. The notion of a mean, on the other hand, does imply such a conception standing distinguished from an average by this feature, namely, the regular march of the groups, increasing to a maximum, and then again diminishing. An average gives us no assurance that the future will be like the past; a mean may be reckoned on with the most implicit confidence."

Table J.— Showing the average and mean measurements, in respect to six items, of 2106 students between 15 years and 3 months and 35 years and 6 months of age, with an average age of 21 years and 1 month.

Weight, . .	138.84 lbs.	=	63.00 k.	131.00 lbs.	=	59.40 k.
Height, . .	67.56 lbs.	=	1.72 m.	67.34 in.	=	1.71 m.
Chest girth, .	35.40 in.	=	89.90 c.m.	35.50 in.	=	90.00 m.
Arm girth, .	11.02 in.	=	27.99 c.m.	11.25 in.	=	28.57 c.m.
Lung capacity,	241.70 cu. in.	=	3960.70 c.c.	230 cu. in.	=	3769.40 c.c.
Body lift, . .	10.25 times.			11 times.		

A study was made showing the relation of the trunk, the arm reach, and the horizontal length of the body.

The results given below (*Table K*) were secured from measurements of 327 students, the whole college numbering 340. The measurements were taken during March and April, 1882, and the average age of all men measured was 21 years and six months.

One of the objects to be gained from this work is to learn the relation between the length of the cerebro-spinal column, the perpendicular height of the body, its length when extended horizontally, and the distance between the tips of the middle fingers when the arms are fully extended.

Medical Director Ruschenberger of the U. S. Army says: "It seems probable that the length of the cerebro-spinal column may be a more valuable element in estimating the physical qualifications of a recruit than total stature. Observation has led me to conjecture that as a rule men of average height, made up of a long trunk and comparatively short lower extremities, possess greater power to endure with impunity great labor and exposure to vicissitudes of all kinds than men who have comparatively long lower limbs and short trunk."

The relative measurements of these portions of body have been made, and the results are seen in the appended table. And these results are given by class averages, and by averages of the aggregate students, which are expressed both in the metric and in the English system.

The finger reach is	1.787 metres, or	70 355 inches.
The horizontal length is . .	1.748 " "	68.820 "
The perpendicular height is .	1.729 " "	68.071 "
The sitting height is . . .	907 millimetres or	35.709 "

We seem, then, to learn from these statistics that a college student, as expressed by an Amherst average, may expect to give a trunk measurement proportioned to his total height of 1.1906. This is a difference of 822 millimetres, or about 32 inches, and the trunk is more than half the total height of the body. The difference in length between the body lying down and the body standing erect is 19 millimetres, or about three-quarters of an inch, in favor of the horizontal measure. The measure of the tips of the fingers exceeds the total height by 39 millimetres, or about one and one-half inches.

Table K.

	Number of Men.	Finger Reach.	Horizontal Length.	Height of Whole Body.	Sitting Height.
Seniors.....	64	1.805	1.776	1.773	910
Juniors.....	95	1.787	1.763	1.739	919
Sophomores.....	79	1.779	1.727	1.716	902
Freshmen.....	89	1.777	1.725	1.689	897
Average.....	.....	1.787	1.748	1.729	907

See *Table L* on page 598.

Up to nearly this time, 1882, our statistical work had been directed very much to averages, means, development, and growth. But all along the thought had been pressing itself forward that there is some standard by which to estimate the proper growth and development of the student; or at least we must have some method to work by advisedly. It was perhaps well enough for the average, the mean, the 50 per cent man, but what can we do for all the others? The thought of the *Stature or Bodily Height* seemed a desirable field to work in, and accordingly the whole effort was devoted to *arranging all the measurements in groups of heights running one centimetre each.* The first table of this descrip-

Table L.

Measures of the Weight, Height, Chest Girth, Arm Girth, Lung Capacity, and Pull Up of the students of Amherst College, gathered between the academic years of 1861–62 and 1884–85, inclusive, noted in the English and in the *Metric* system. Arranged and averaged by Age, and of 7988 individuals.

Age of the Students.	Number of Students Measured at Each Year.	Weight in Pounds and Decimals.	*Weight in Kilos and Tenths.*	Height in Inches and Hundredths.	*Height in Metres and Millimetres.*	Chest Girth in Inches and Hundredths.	*Chest Girth in Millimetres.*	Arm Girth in Inches and Hundredths.	*Arm Girth in Millimetres.*	Lung Capacity in Cubic Inches.	*Lung Capacity in Litres.*	Pull Up. Number of Times.
16	30	123.42	*56.1*	66.70	*1.695*	34.20	*868*	10.60	*268*	225.0	*3.68*	8.58
17	390	128.73	*58.5*	66.77	*1.697*	34.23	*870*	11.06	*280*	229.9	*3.80*	9.42
18	1,323	131.09	*59.6*	66.95	*1.700*	35.42	*895*	11.23	*285*	239.3	*3.97*	10.06
19	1,452	133.13	*60.5*	67.12	*1.709*	35.43	*896*	11.40	*290*	244.1	*4.02*	10.18
20	1,478	134.99	*61.3*	67.47	*1.714*	35.63	*905*	11.58	*295*	250.4	*4.11*	10.17
21	1,251	136.37	*61.9*	67.50	*1.716*	35.92	*918*	11.65	*298*	254.0	*4.18*	10.26
22	867	137.61	*62.5*	67.58	*1.720*	36.29	*926*	11.74	*300*	256.9	*4.20*	10.26
23	589	138.95	*63.1*	67.70	*1.721*	36.75	*934*	11.94	*303*	260.5	*4.28*	10.26
24	382	140.33	*63.8*	67.77	*1.722*	37.36	*940*	11.96	*304*	263.0	*4.30*	10.26
25	237	142.34	*64.7*	67.90	*1.726*	37.40	*947*	11.98	*305*	265.0	*4.36*	10.27

tion was made in 1884 from the height of 155 to 183 centimetres of 51 items of measurement from 628 men. Then each man as he was measured, with his record in his own hands, could see his exact relation to the average man of his own height, as determined by the records for many years past.

From this table were constructed cards — one for each centimetre — of the heights already mentioned, and containing the records of the 51 items observed, and side by side of his own record of measures. And upon this same card were given the directions and suggestions of the examiner, when there was a special lack of development, and one with the average of all college for work and development. Besides this it contained the directions for taking the measurements as adopted by the American Association for the Advancement of Physical Education, the method of examining the eyes and ears, and general directions for the use of the development apparatus in the gymnasium.

Two years later another edition of the manual was issued, and today, 1893, a third one is just from the press, with enlarged tables and data, but all tending to confirm the idea that stature is the foundation upon which the idea of the typical student should be constructed, and the source from which all corrections for imperfect or non-development should be made.

It is most interesting to note that the statue of the typical college student exhibited at the Chicago Exposition today most strongly exemplifies this idea.

To conclude, the results of Anthropometry in Amherst College as they stand today are to be found in the tables accompanying this paper, and in the revised tables contained in the third edition of the *Anthropometric Manual of Amherst College, 1893.*

AN ANTHROPOMETRICAL STUDY OF THE EFFECTS OF GYMNASTIC TRAINING ON AMERICAN WOMEN.

By Claës J. Enebuske, A.M., Ph.D.,
Principal of Instruction in the Boston Normal School of Gymnastics.

In order to trace the results of gymnastic training, the students of the Boston Normal School of Gymnastics are measured at regular intervals during the school year. The first measurements are taken at the beginning of the school work in the autumn; the last measurements are taken at the close of the school in the spring. At the beginning of each month those items which are most susceptible to change under the influence of the training are remeasured, and the change in which has most direct influence upon the working capacity and resistive power of the student, so far as is manifest in gymnasium work. The measures taken each month are the weight, lung capacity, strength of legs, back, chest, left and right forearm. At the beginning and close of the work 53 different measurements are taken in all, namely, the standing height, the length, breadth, depth, girth of various parts of the body, taken at distinct anatomical landmarks. Besides these a series of tracings of the form of the chest are taken at the beginning and close of the year. These are made by means of the anthropometric machines, constructed for this purpose by Démeny in Paris. They consist of, 1st, tracing of thorax in horizontal section, with chest in inspiratory — repose — and expiratory position; 2nd, tracing of the median profile of the trunk with chest in inspiratory, repose, and expiratory position; 3rd, the antero-posterior curve of the back; 4th, the mid-spinal line.

In the present paper we wish to present a part of the results attained by the study of the measurements of *one hundred junior students of the school.** The first observation

* The measurements have been made by Miss M. Anna Wood, of Wellesley College, and Miss Margaret S. Wallace, of the Boston Normal School of Gymnastics.

was made before the training began, or in the early part of the training; the second observation was made seven months later. During the intervening period, *i. e.*, from October to May, the students had one hour's gymnastic training five days a week, besides attending the required lectures and recitations. The ages of the students range from seventeen to forty-two years. The distribution of age at the beginning of the training is shown in the following table: —

TABLE I. AGE AT THE FOLLOWING PERCENTILE GRADES.

Percentile Grade.	5.	10.	20.	30.	40.	50.	60.	70.	80.	90.	95.
Years.....	19	19¼	20¼	21	22	23¼	25¼	27	30	35	37

Height. The highest and lowest statures of these 100 students were 171.3 and 147 centimetres, respectively. Table II shows the distribution of height before and after the training.

TABLE II. HEIGHT.

Percentile Grade.	5.	10.	20.	30.	40.	50.	60.	70.	80.	90.	95.	Unit.
Before the training.....	151.3	152.8	154.9	156.6	158.6	160.1	160.7	162.7	164.8	167.5	169.5	Centimetre.
After 7 months' training.....	152.0	153.0	155.0	156.8	158.8	160.2	161.5	163.2	166.5	167.6	169.6	

Weight. The highest and lowest weights observed in these cases are, before the training, 74.3 and 40.2 kilos., respectively; after the training, 72.9 and 38.4 kilos., respectively. Table III shows the value of the following percentile grades before and after training: —

TABLE III. WEIGHT.

Percentile Grade.	5.	10.	20.	30.	40.	50.	60.	70.	80.	90.	95.	Unit.
Before the training.....	43.5	45.0	47.5	49.5	51.5	53.4	55.0	57.5	59.7	63.1	65.8	Kilos.
After 7 months' training.....	43.5	44.8	47.1	49.1	51.7	53.3	55.2	57.3	59.4	62.1	66.4	

It will be seen that a slight diminution in weight has taken place generally (the exceptions being at the 40, 60, and 95 per cent grades).

Lung Capacity. The highest and lowest lung capacity observed in these cases are, before the training, 3.76 and 1.31 litres, respectively; after the training, 4.1 and 1.97 litres, respectively. Table IV shows the value of the following percentile grades: —

TABLE IV. LUNG CAPACITY.

Percentile Grade.	5.	10.	20.	30.	40.	50.	60.	70.	80.	90.	95.	Unit.
Before the training.....	2.13	2.27	2.40	2.46	2.56	2.65	2.75	2.87	2.95	3.07	3.35	Litre.
After 7 months' training.....	2.27	2.38	2.54	2.65	2.72	2.87	2.96	3.03	3.12	3.29	3.43	

It is seen that increase of lung capacity has taken place at all the percentile grades. After seven months' gymnastic training the value of the 30 per cent grade (2.65) is equal to the value at the 50 per cent grade before the training, and the value at the 50 per cent grade after the training (2.87) is equal to the 70 per cent grade before the training.

Strength of Legs. The extreme values observed are, before the training, 148 and 60 kilos., respectively; after the training, 190 and 81 kilos., respectively. Table V gives the value of the following percentile grades: —

TABLE V. STRENGTH OF LEGS.

Percentile Grade.	5.	10.	20.	30.	40.	50.	60.	70.	80.	90.	95.	Unit.
Before the training.....	68.0	70.0	78.0	80.0	88.0	93.0	100.0	105.0	119.5	131.5	139.5	Kilos.
After 7 months' training..... ..	87.5	94.5	100.0	108.5	115.0	120.0	127.5	135.0	145.0	160.0	168.5	

Increase has taken place at all the percentile grades. After the training the value at the 10 per cent grade (94.5) is higher than the value of the 50 per cent grade before the

training (93), and the 50 per cent value after the training (120) is higher than the 80 per cent value before the training (119.5).

Strength of Back. The extreme values were, before the training, 100 and 40 kilos., respectively; after the training, 124 and 48 kilos., respectively. Table VI shows the value of the following percentile grades: —

TABLE VI. STRENGTH OF BACK.

Percentile Grade.	5.	10.	20.	30.	40.	50.	60.	70.	80.	90.	95.	Unit.
Before the training.....	45.5	49.0	52.5	57.5	60.5	65.5	70.0	75.0	80.5	90.0	91.5	Kilos.
After 7 months' training.....	60.0	66.0	72.0	77.0	78.0	81.5	86.0	91.5	95.0	100.0	104.0	

Increase has taken place in all the grades. The 10 per cent value after the training (66) is higher than the 50 per cent value before the training (65.5), while the 50 per cent value after the training (81.5) is higher than the 80 per cent value before the training (80.5), and the 70 per cent value after the training (91.5) is equal to the 95 per cent value before the training.

Strength of Chest. The extreme values before the training were 37 and 15 kilos., respectively; after the training, 48 and 18 kilos., respectively. Table VII shows the value of the following percentile grades: —

TABLE VII. STRENGTH OF CHEST.

Percentile Grade.	5.	10.	20.	30.	40.	50.	60.	70.	80.	90.	95.	Unit.
Before the training.....	19.0	20.5	24.0	25.0	26.0	27.0	28.0	29.0	30.3	32.8	34.0	Kilos.
After 7 months' training.....	24.5	26.8	28.5	29.8	31.0	32.0	33.0	35.0	36.5	39.0	39.0	

Increase has taken place in all the grades. The 10 per cent value after the training (26.8) is slightly below the 50 per cent value before the training (27), while the 50 per cent

value after the training (32) is higher than the 80 per cent value before the training (30.3), and nearer the 90 per cent value (32.8) before the training.

Strength of Right Forearm. The extreme values were, before the training, 36 and 10 kilos., respectively; after the training, 39 and 19, respectively. Table VIII gives the value of the following percentile grades: —

TABLE VIII. STRENGTH OF RIGHT FOREARM.

Percentile Grade.	5.	10.	20.	30.	40.	50.	60.	70.	80.	90.	95.	Unit.
Before the training.....	16.0	20.0	22.0	24.0	25.0	26.0	27.0	28.0	30.0	31.5	33.0	Kilos.
After 7 months' training.....	20.0	23.0	24.5	25.0	27.0	28.0	29.0	30.0	32.5	34.5	37.0	

There is increase consequently at all the grades. The 50 per cent value before the training (26) is reached between the 30 and 40 percentile grades after the training, and the 50 per cent value after the training is equal to the 70 per cent value before the training.

Strength of Left Forearm. The extreme values were, before the training, 37 and 9 kilos., respectively; after the training, 38 and 16, respectively. Table IX gives the value of the following percentile grades: —

TABLE IX. STRENGTH OF LEFT FOREARM.

Percentile Grade.	5.	10.	20.	30.	40.	50.	60.	70.	80.	90.	95.	Unit.
Before the training.....	14.5	16.0	19.0	20.0	21.0	23.0	24.0	25.0	26.0	28.5	30.5	Kilos.
After 7 months' training.....	18.0	19.0	20.5	23.0	24.0	25.0	26.0	27.0	29.0	31.0	33.0	

Increase is found in all grades. The 30 per cent value after the training (23) equals the 50 per cent value before the training, and the 50 per cent value after the training (25) equals the 70 per cent value before the training.

Total Strength. By this term is understood the sum of the five strength tests mentioned. The extreme values

were, before the training, 311 and 156.5 kilos., respectively; after the training, 409 and 202.5 kilos., respectively. Table X gives the value of the following percentile grades: —

TABLE X. TOTAL STRENGTH.

Percentile Grade.	5.	10.	20.	30.	40.	50.	60.	70.	80.	90.	95.	Unit.
Before the training.....	176.0	191.0	201.0	213.0	221.0	230.5	243.5	264.0	277.5	293.5	310.0	Kilos.
After 7 months' Training.....	219.0	237.5	254.5	271.0	285.0	293.0	301.5	313.0	325.0	341.0	371.0	

This table shows that the total strength of the 10 per cent grade after the training (237.5) surpasses the 50 per cent grade before the training (230.5), and approaches the 60 per cent grade value (243.5). The 50 per cent value after the training (293) nearly equals the 90 per cent value before the training (293.5), and the 70 per cent value after the training (313) is beyond the 95 per cent value before the training (310).

It is of interest to study the ratio of some of the items mentioned.

Ratio of weight and height, *i. e.*, $\frac{W}{H}$ (W = weight in kilo., H = height in centimetres) expresses how much weight an individual possesses for every centimetre of his stature; for instance, $\frac{W}{H} = 0.340$, *i. e.*, 0.340 kilos. for each centimetre of stature. For the sake of convenience this ratio will be spoken of under the term *weight-height index.* Besides, we present tables indicating the influence of the training upon the following indices: —

Ratio of lung capacity (in litres) and weight $\left(\frac{L\,C}{W}\right)$, *i. e.*, vital capacity-weight index, or, for brevity's sake, *vital index.*

Ratio of total strength (kilos.) and weight $\left(\frac{T\,S}{W}\right)$, *i. e.*, *strength-weight index.*

The product obtained by multiplying vital index by strength-weight index $\left(\frac{L\,C \times T\,S}{W^2}\right)$, *i. e.*, *vital strength-weight index.*

The product obtained by multiplying vital index by total strength $\left(\frac{L\,C}{W} \times \frac{T\,S}{}\right)$, *i. e., power index.*

The four indices last mentioned were discussed by the writer in a paper read before the American Association for the Advancement of Physical Education, at its eighth annual meeting in Philadelphia, April, 1892, entitled "Some Measurable results of Swedish Pedogogical Gymnastics," and printed in the proceedings of that Association. To this paper those are referred who are interested in a further description of the indices. Here we will only quote some of the results summed up.

1. The *vital strength-weight index* grows parallel with the growth of efficiency and adaptability to gymnastic exercises; and is indicative of the degree of an individual's training with reference to gymnastic exercises. This index becomes still more instructive in this respect if its component vital index and strength-weight index are consulted also.

2. Under ordinary circumstances those women of vital strength-weight index lower than 0.2000 are not in condition for gymnastic exercises so vigorous as climbing; those of 0.3000 or more are in excellent condition for such exercises; those between 0.2000 and 0.3000 are between unable and well-conditioned.

3. Under ordinary circumstances the *vital index* necessary for ability to climb is in the neighborhood of 0.0474, but in combination with a high strength-weight index or a very energetic moral disposition some imperfect climbing may exist with even lower vital index, and has been observed in a case with as low a vital index as 0.0444.

4. Under ordinary circumstances the *strength-weight* index necessary for ability to climb is about 5.4; but, in combination with high vital index or a very energetic disposition, climbing may be possible with lower strength-weight index, and some imperfect climbing has been observed in a case with strength-weight index only 3.6.

5. Two vital strength-weight indices of equal number may have different values, as exponents of physical efficiency, depending upon whether they are composed of a vital index and a strength-weight index of corresponding heights or of a high and a low index.

6. So far as can be judged from observation of about 100 cases, the vital strength-weight indices of women which correspond to the highest efficiency of the most manifold adaptability in the gymnasium are those composed of a strength-weight index of 6.2 or more, and a vital index of 0.0550 to 0.0600 or somewhat above 0.0600. Those composed of a low strength-weight index and a vital index considerably higher than 0.0600 (0.0650 or more) are more difficult to estimate, and their number is comparatively small.

As an illustration of the correlation between the growth of the vital strength-weight index and the growth of working capacity in the gymnasium the following table is offered. It will be understood without further explanation than to say that the marks are our subjective estimate of the capacity of the students to climb the perpendicular rope. The figures indicate the number of students who have the index as given at the top of the perpendicular column, and the mark in climbing as given at the head of the horizontal column. A^1 means excellence; C, entire inability; B^2, the first struggling success to climb a few inches upward; the other marks indicate the intermediate stages of proficiency.

TABLE XI. Comparison of Vital Strength-Weight Indices and Marks in Climbing of 51 Junior Students of the Boston Normal School of Gymnastics.

	0.1650–0.1999.	0.2000–0.2499.	0.2500–0.2599.	0.2600–0.2699.	0.2700–0.2799.	0.2800–0.2899.	0.2900–0.2999.	0.3000–0.3499.	0.3500–0.3999.	0.4000–0.4499.	0.4500–0.5000.	0.5000–0.5270.	Total.
A^1.....	...	....	....	*3	....	....	....	10	3	3	....	1	20
A^2.. ...	....	*2	....	*1	1	1	2	....	....	....	....	....	7
Ab^1....	....	1	2	1	2	....	....	....	....	....	....	....	6
Ab^2....	....	3	2	....	1	....	....	1	....	....	....	....	7
B^1.....	....	2	....	....	....	....	....	....	....	....	....	....	2
B^2.....	*1	2	1	....	. ..	....	...	....	....	....	....	....	4
C.....	4	....	....	1	....	....	....	....	....	....	....	....	5
Total...	5	10	5	6	4	1	2	11	3	3	....	1	51

Imperfect climbing under difficulty corresponds to index				0.2000–0.2500
Growing ability to climb corresponds to index			. .	0.2500–0.3000
Ease in climbing	"	"	. .	0.3000–0.3500
Great ease in climbing	"	"	. .	0.3500–

While the vital strength-weight index grows parallel with aptitude in such exercises as demand the weight of the body to be lifted by the individual's own muscles (as climbing, jumping, etc.), the power index shows a more marked correspondence with the growing capacity in such exercises in which outer resistance is combated. It deserves to be noted that the power index, being the product of vital index and total strength, *i. e.*, $\left(\frac{L\,C \times T\,S}{W}\right)$, is also the product of vital strength-weight index and weight, *i. e.*, $\frac{L\,C \times T\,S}{W^2} \times W = \frac{L\,C \times T\,S}{W}$

Weight-Height Index. The extreme values are, before the training, 0.454 and 0.270, respectively; after the training, 0.454 and 0.259, respectively. Table XII gives the value of the following percentile grades: —

TABLE XII. WEIGHT-HEIGHT INDEX.

Percentile Grade.	5.	10.	20.	30.	40.	50.	60.	70.	80.	90.	95.
Before the training	0.279	0.290	0.299	0.312	0.322	0.331	0.343	0.351	0.372	0.389	0.401
After 7 months' training	0.274	0.286	0.301	0.312	0.320	0.330	0.344	0.351	0.366	0.384	0.405

The general tendency has been towards a slight diminution of this index under the influence of the training.

Vital Index. The extreme values are, before the training, 0.0710 and 0.0307, respectively; after the training, 0.0720 and 0.0409, respectively. Table XIII gives the values of the following percentile grades: —

TABLE XIII. VITAL INDEX.

Percentile Grade.	5.	10.	20.	30.	40.	50.	60.	70.	80.	90.	95.
Before the training	0.0384	0.0407	0.0430	0.0456	0.0480	0.0499	0.0513	0.0536	0.0570	0.0602	0.0661
After 7 months' training	0.0438	0.0450	0.0475	0.0495	0.0506	0.0530	0.0550	0.0565	0.0590	0.0630	0.0661

Increase of this index has been the general result of the training, except in the highest percentile grades, and the increase has been greatest at the lower grades. The value at the 30 per cent grade after the training (0.0495) approaches the 50 per cent value before the training (0.0499), and the 50 per cent value after the training (0.0530) approaches the 70 per cent value before the training (0.0536).

Strength-Weight Index. The extreme values observed are, before the training, 6.4 and 2.87, respectively; after the training, 7.33 and 3.6, respectively. Table XIV gives the values of the following percentile grades: —

TABLE XIV. STRENGTH-WEIGHT INDEX.

Percentile Grade.	5.	10.	20.	30.	40.	50.	60.	70.	80.	90.	95.
Before the training.....	3.26	3.47	3.72	3.96	4.12	4.40	4.53	4.8	5.27	5.70	5.98
After 7 months' training.....	4.02	4.36	4.77	4.94	5.28	5.48	5.66	6.0	6.35	6.65	7.60

Increase of this index has taken place at all the grades. The value of the 10 per cent grade after the training (4.36) reaches nearly the 50 per cent value before the training (4.40), while the 50 per cent value after the training (5.48) is about equal to the 85 per cent grade before the training.

Vital Strength-Weight Index. The extreme values are, before the training, 0.415 and 0.108, respectively; after the training, 0.527 and 0.166, respectively. Table XV shows the values of the following percentile grades: —

TABLE XV. VITAL STRENGTH-WEIGHT INDEX.

Percentile Grade.	5.	10.	20.	30.	40.	50.	60.	70.	80.	90.	95.
Before the training.....	0.1290	0.1480	0.1710	0.1925	0.2050	0.2180	0.2385	0.2530	0.2730	0.3170	0.3320
After 7 months' training.....	0.1925	0.2150	0.2445	0.2575	0.2690	0.2845	0.3060	0.3325	0.3600	0.3810	0.4100

We find that the value of the 10 per cent grade after the training (0.2150) approaches the 50 per cent value before the training (0.2180), and that the 50 per cent value after

the training (0.2845) is higher than the 80 per cent value before the training (0.2730).

Comparing with the subjective estimate of ability to climb, referred to above, we find that the vital strength-weight index necessary for climbing is —

With difficulty (about 0.2000) before training at 40 per cent, after training at 10 per cent.

Ability (about 0.2500) before training at 70 per cent, after training at 30 per cent.

Ease (about 0.3000) before training at 90 per cent, after training at 60 per cent.

Great ease (about 0.3500) before training at 00 per cent, after training at 75 per cent.

Power Index. The extreme values of this index are, before training, 18.6 and 4.9, respectively; after training, 25 and 9.3, respectively. Table XVI gives the values of the following percentile grades: —

TABLE XVI. POWER INDEX.

Percentile Grade.	5.	10.	20.	30.	40.	50.	60.	70.	80.	90.	95.
Before the training.....	8.10	8.65	9.9	10.35	11.10	11.9	12.45	13.15	13.95	15.10	15.50
After 7 months' training.....	11.05	11.65	13.3	14.10	14.85	15.7	16.40	17.15	17.70	18.95	19.95

The value of the 10 per cent grade (11.65) after the training approaches the 50 per cent value before the training (11.9), while the 50 per cent value after the training (15.7) surpasses the value of the 95 per cent grade before the training (15.5).

The anthropometrical data which we have presented above justify the opinion that the susceptibility of American women to gymnastic training is considerable. The tables of strength and lung capacity, and, still better, the computed indices, the vital strength-weight index, and the power index, show that by seven months' training the mere physical working capacity of these women, such as manifests itself in gymnasium work, has grown from the 10 per cent grade to the 50 per cent grade, and from the 50 per cent grade to the 80 or 90 per cent grade.

Synopsis.]

RAILWAY FREIGHT TRAFFIC STATISTICS.

By C. P. Leland,

Auditor of the Lake Shore & Michigan Southern Railway Co., and President, 1892-93, of the Association of American Railway Accounting Officers.

Within the last few years statistics have come to be valued as a vital necessity to the successful operation of our railways.

Perhaps the Lake Shore & Michigan Southern Railway, with its eastern terminus at Buffalo, at the foot of the Great Lakes, and its western terminus at Chicago, the head of the Great Lakes, traversing six great states, with branches largely exceeding in mileage its main line, has as great a variety of traffic as any railway in this country. While it has but 1454 miles of road (less than one per cent of the mileage of the United States) it handled, in 1892, 13,643,747 tons of freight and 5,846,755 passengers. As I myself have kept its statistics for thirty-three of its forty-one years, and have made up and issued thirty-three consecutive annual reports (1860–92), I shall confine the inquiry to the statistics of that railroad.

RATES.

The average rate per ton per mile can be had for thirty-nine years, since 1853. During this period, in 1868, the Bessemer steel rail was introduced. Notice the tendency of rates from 1868, as shown in the following table: —

Average Rate per Ton per Mile of the Lake Shore & Michigan Southern Railway.

Years.	Cents.	Years.	Cents.	Years.	Cents.
1854	3.510	1867	2.427	1880	.750
1855	3.210	1868	2.336	1881	.617
1856	2.960	1869	1.714	1882	.628
1857	2.740	1870	1.504	1883	.728
1858	2.380	1871	1.391	1884	.652
1859	2.292	1872	1.374	1885	.553
1860	2.157	1873	1.335	1886	.639
1861	2.092	1874	1.180	1887	.670
1862	2.099	1875	1.010	1888	.636
1863	2.296	1876	.817	1889	.664
1864	2.833	1877	.864	1890	.626
1865	2.903	1878	.734	1891	.628
1866	2.476	1879	.642	1892	.599

This table shows that the rate per ton per mile for 1892, a trifle under six mills, was but —

80	per cent	of the	rate for	1880
40	"	"	"	1870
28	"	"	"	1860
17	"	"	"	1854

When a railroad moves 100 tons of average freight one mile for a little less than 60 cents it would seem as if the bottom had been reached. The great majority of the railroads in the United States could not meet their fixed charges with an average rate of six, or even eight, mills per ton per mile.

With a considerably higher average rate in 1892 (a little less than one cent per ton per mile, .967), all the railroads of the United States, out of gross earnings aggregating $1,205,272,023, paid but $83,336,811 in dividends on $4,920,555,225 capital stock, less than 1.7 per cent, and 1892 was a very prosperous year. A further reduction in the average rate per ton per mile of only one mill, 10 per cent, would cut down the freight earnings of all the railroads in the United States $84,448,197, thus obliterating the aggregate dividends of 1892 ($83,336,811).

This close margin thus shows the vital necessity of scrutinizing freight statistics.

COMMODITY STATISTICS.

To an intelligent management of a railway, seeking how and where to increase its traffic, commodity statistics are of inestimable value.

The Lake Shore freight traffic is divided into 14 commodities, or general heads. I here give the figures for 1870 and for 1892, showing the growth of each commodity in 23 years.